THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK APRIL, 1906

# A Distillery Power and Heating Equipment

***The Federal Distilling Company, Colgate Station, Baltimore, Md.***

A distillery power plant that is not only thoroughly modern in its equipment but also furnishes power for cooking and boiling, and, in addition, heats, by means of its exhaust steam, no less than 16 detached buildings, has recently been installed for the Federal Distilling Company, of Baltimore, and is illustrated in the following pages.

In some of the buildings it is necessary to maintain a continuous temperature of 90 degrees, which brings the total amount of direct radiation in the various buildings up to approximately 12,000 square feet.

## POWER HOUSE EQUIPMENT

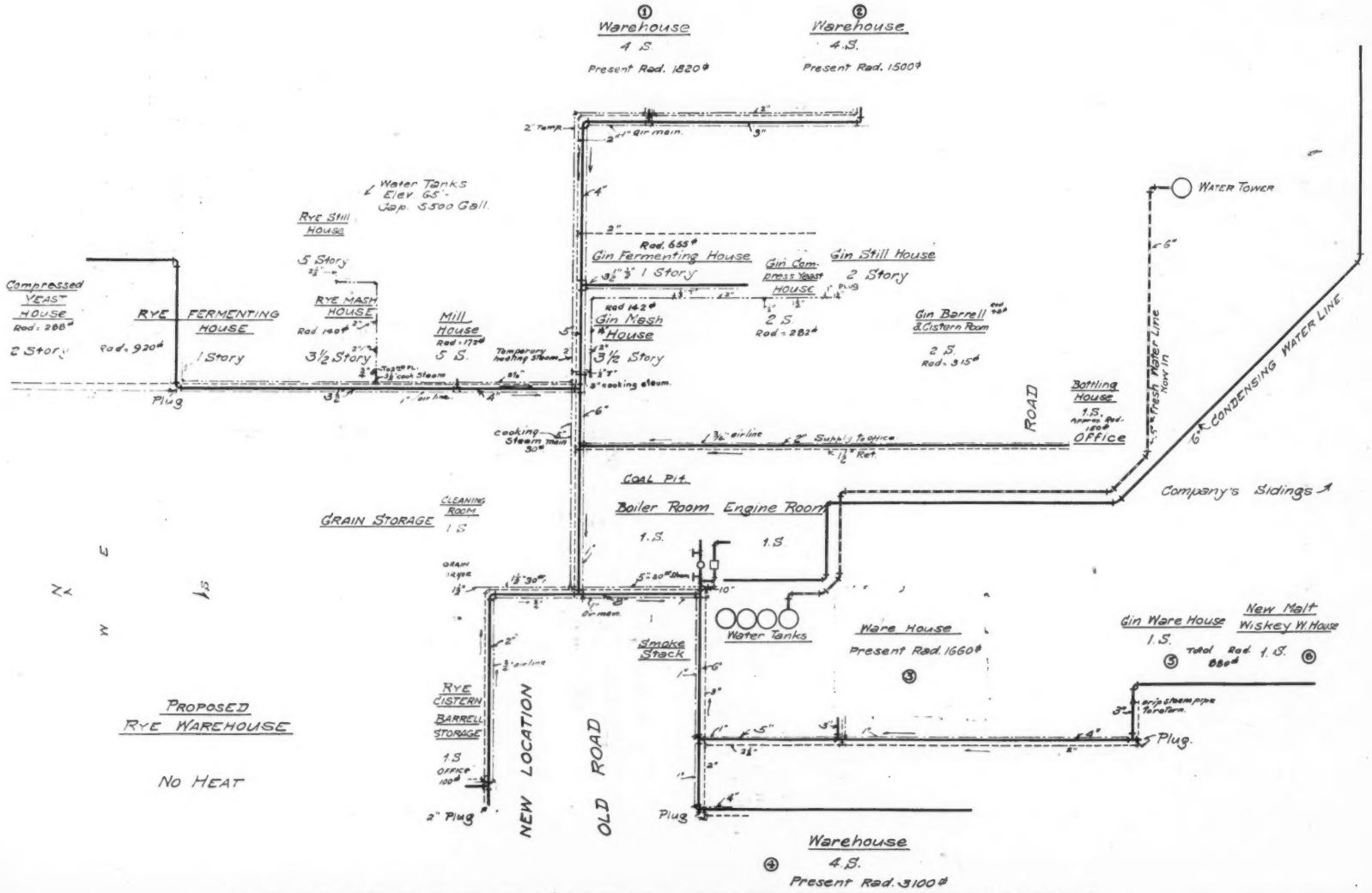
Included in the equipment of the power house are two high pressure water tube boilers, with space for a third, a feed water heater, two boiler feed pumps, a pump and receiver, three steam turbo-generators, switchboard, etc., and two steam-driven air compressors. The high pressure steam piping is designed to operate under a gauge pressure of 150 pounds. The turbo-generators supply some 60 electric motors which are distributed in the different buildings and drive the various machinery.

The exhaust line from each turbine is continued to a main exhaust pipe in a trench under the floor. This pipe is extended so as to supply the heating system and has branches to the condenser, heater and free exhaust. The exhaust from the air compressor and pumps is connected into a separate line and carried overhead with an oil separator, as shown in the illustration. The feed water is supplied from a number of deep wells which are pumped by means of compressed air and discharge into large storage tanks. A suction is taken from these tanks and connected to two boiler feed pumps, each 7¼x4½x10 inch Duplex, designed to pump against a boiler pressure of 150 pounds.

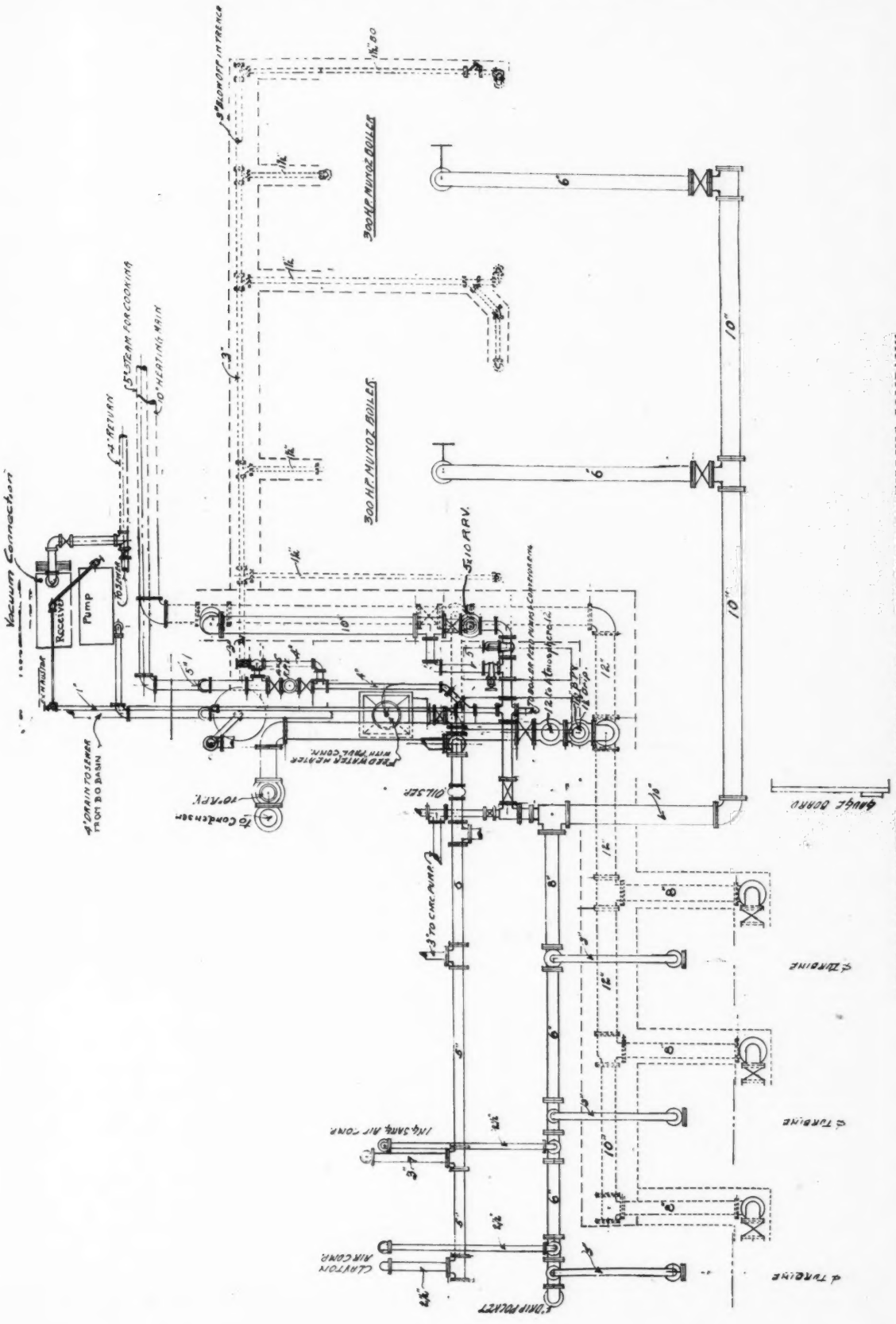
A barometric condenser of ample capacity for condensing the excess of exhaust steam and a steam circulating pump of corresponding capacity have been provided and arranged so that the heating system may be operated under moderate vacuum conditions; that is, at minus pressure in all the radiating surfaces and, consequently, minus pressure at the engines. The condensing water is taken from a creek, about 60 feet distant. A live steam supply for the mash tubs, stills and dryers in the various buildings is connected in the boiler room through the reducing valves, bringing down the pressure to 80 pounds.

## HEATING SYSTEM

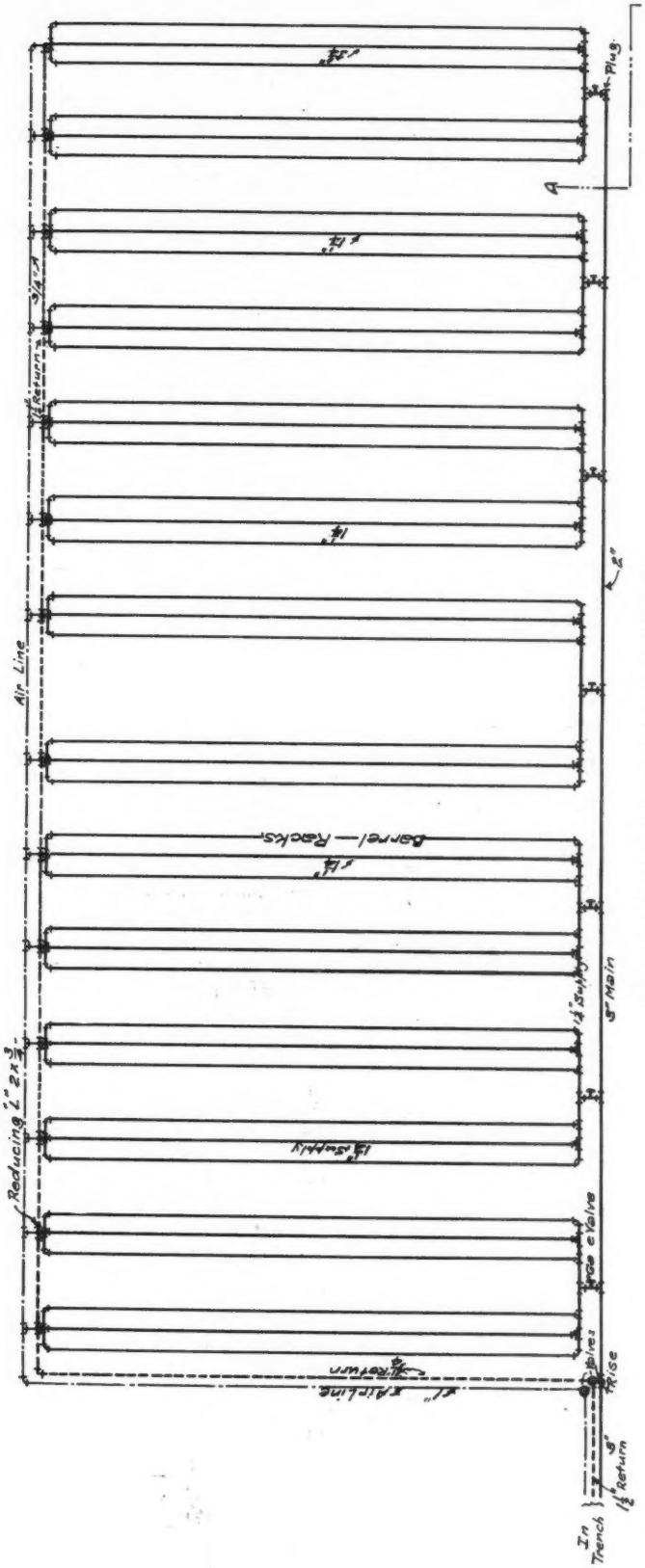
The heating apparatus is arranged to circulate steam at or below atmospheric pressure and to return the water of condensation to the pump and receiver without the aid of mechanical devices. A peculiar feature of the system is the use of exhaust steam for heating taken from apparatus running under condensing conditions. At the time the work was undertaken there was approximately 8,230 square feet of direct radiation operated by live steam in various old buildings. This was remodelled and connected with the new system which included 4,000 square feet in addition. Back pressure


① Warehouse 4 S. Present Rad. 1820 ft
② Warehouse 4 S. Present Rad. 1500 ft
Water Tanks Elev. 65' Cap. 5500 Gall.
Rye Still House 5 Story
Compressed Yeast House Rad. 288 ft 2 Story
Rye Fermenting House Rad. 920 ft 1 Story
Rye Mash House Rad 140 ft 3½ Story
Mill House Rad. 1720 ft 5 S.
Gin Fermenting House Rad. 655 ft 1 Story
Gin Com. press Yeast House 1 S. Rad. 282 ft
Gin Still House 2 Story
Gin Mash House Rad 142 ft 3½ Story
Gin Barrell & Cistern Room 2 S. Rad. 315 ft
Water Tower
Fresh Water Line from Main
Condensing Water Line
Bottling House 1 S. Approx. Rad. 1000 ft
Office
Road
Company's Sidings
Coal Pit
Boiler Room
Engine Room
1 S.
Grain Storage
Cleaning Room 1 S
Water Tanks
Ware House Present Rad. 1660 ft ③
Gin Ware House 1 S.
New Malt Wiskey W. House
Total Rad. 1 S. 880 ft ⑤ ⑥
Smoke Stack
Proposed Rye Warehouse
No Heat
Rye Cistern Barrell Storage 1 S Office 100 ft
New Location
Old Road
Plug
Warehouse 4 S. ④ Present Rad. 3100 ft

PLOT PLAN OF THE STEAM PIPING AT THE PLANT OF THE FEDERAL DISTILLING COMPANY



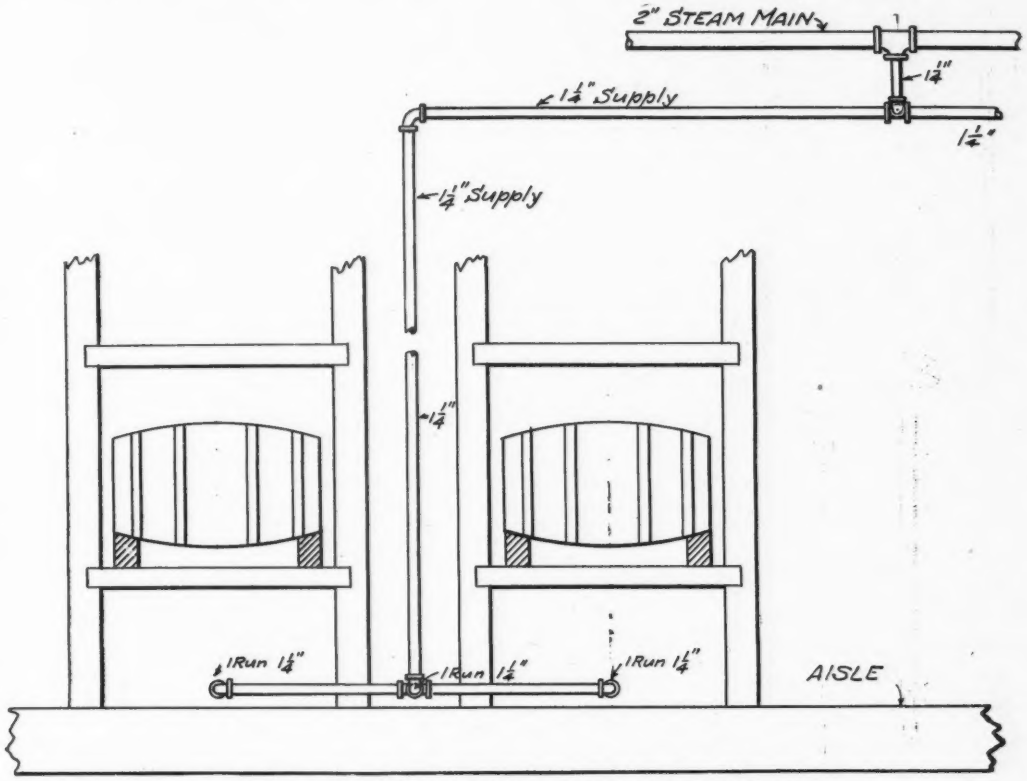

PIPING CONNECTIONS IN POWER STATION, FEDERAL DISTILLING COMPANY



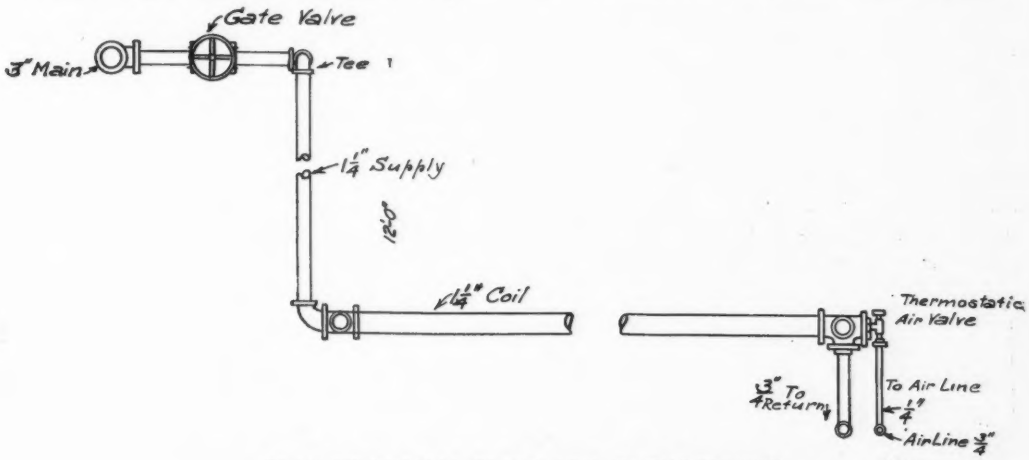

HEAT PLAN OF ONE OF THE WAREHOUSES

and two reducing pressure valves were installed, the latter being located in the boiler room with by-passes around each. For this system a Worthington automatic pump, 6x4x6 Duplex and receiver were set in the boiler room at a point sufficiently low to permit the water of condensation from the radiators and coils to flow by gravity to the receiver.

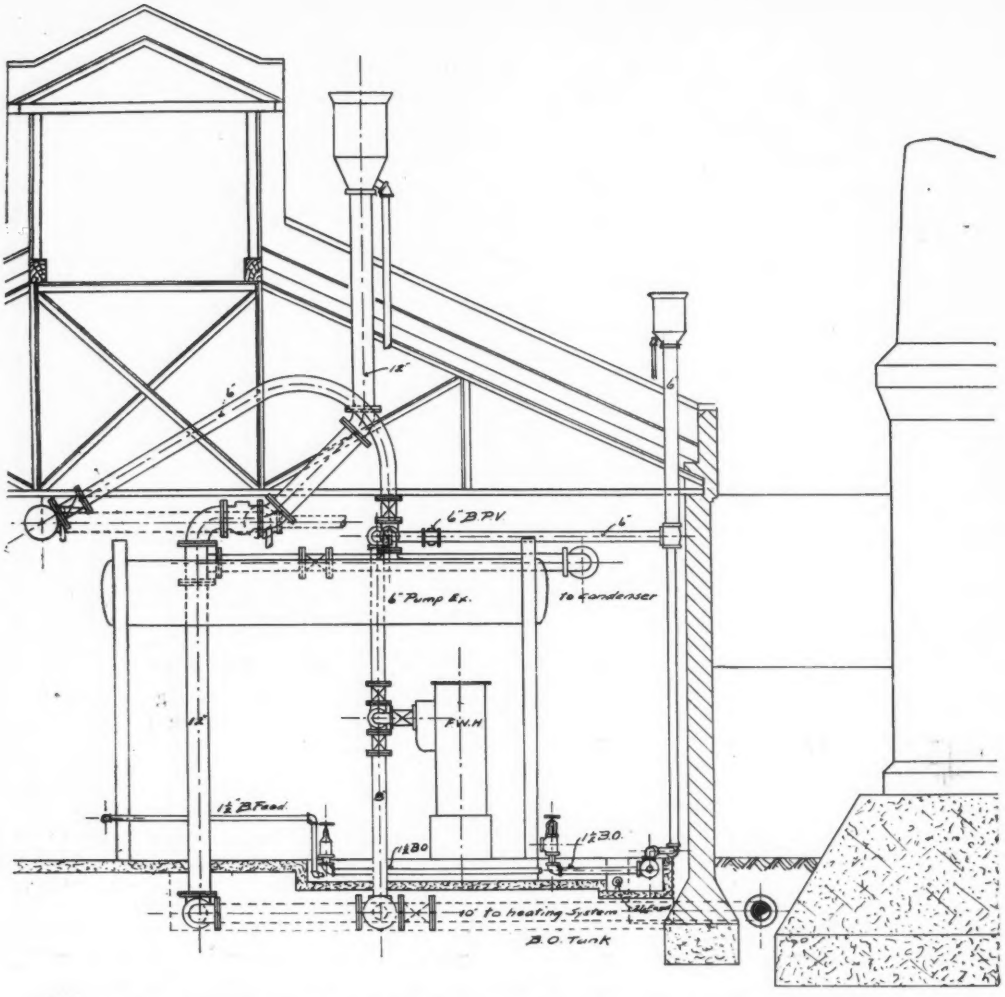
An oil separator is installed in the main exhaust line from the pump and compressor at the point shown in the illustration. The feed water heater is of 800 H. P., open, with oil separator and purifier combined. In connection with this heater, the plans call for an automatic device for controlling the overflow return from the heating system, so that the heat-




ELEVATION OF ONE OF THE COILS IN WAREHOUSE




PLAN OF TYPICAL FLOOR COIL IN WAREHOUSE




CROSS SECTION OF POWER STATION, FEDERAL DISTILLING COMPANY, SHOWING POWER PIPING

er may be operated under vacuum conditions.

CONSTRUCTION OF TRENCHES

The manner in which the steam mains and returns are carried is of interest. In every case they are run underground in vitrified split tile conduits with cemented joints, and made water tight. For insulation, they are covered with sectional magnesia covering.

All of the radiation consists of wrought iron or steel wall coils. The old warehouses were previously heated with live steam in coils, placed on the floor. Under the new arrangement, the necessary changes were made to make the coils suitable for

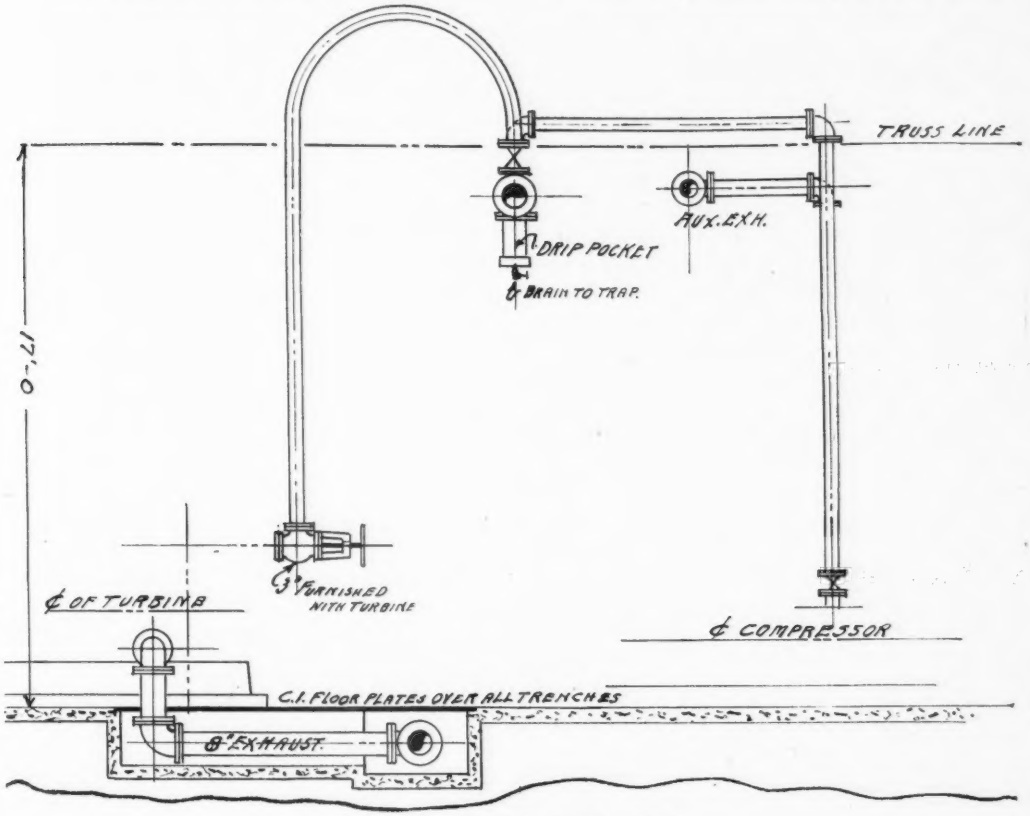
METHOD OF CARRYING UNDERGROUND PIPING IN PORTLAND SECTIONAL CONDUITS

exhaust steam. All the other radiation that was in use has been similarly altered, although the idea was considered of supplying the old warehouses with live steam from the live steam supply to the still, mash tubs, etc.

The Paul System is installed at the plant with the exhausting apparatus for same placed in the engine room. A high pressure steam supply to the exhausting apparatus is provided and the discharge from same is connected to the catch basin, into which the blow-off mains from the boilers also discharge and which is of cast iron, 24 inches in diameter by 36 inches deep. The outlet from this basin is connected to the sewer.

A number of methods of manufacture entirely new for distilleries of this character, which were invented by Mr. Otto Luyties, the general manager, were incorporated in this plant, the most important being a new yeast system which bids fair to revolutionize the distilling business.

The power and heating equipment was designed by Mr. Charles G. Armstrong, of New York, and the plant installed by the New York Steam Fitting Company, of New York.

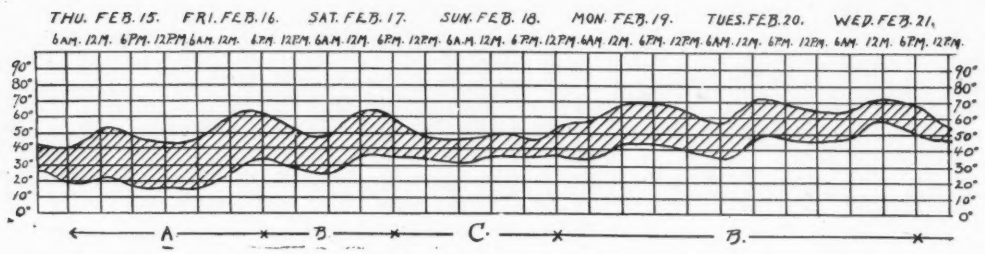



ELEVATION IN ENGINE ROOM

## Testing Heating Apparatus with Recording Thermometers

Heating is probably the oldest mechanical art that is used in connection with buildings, and it seems to be one of the most neglected in the line of the preservation of scientific records of its action and results.

Instruments for testing and recording the action of more recently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90° 80° 70° 60° 50° 40° 30° 20° 10° 0°
A
B
C.
B.

HEATING CHART IN FACTORY BUILDING SHOWING FLUCTUATIONS IN OUTSIDE AND INSIDE TEMPERATURES

A—Maximum Heating Effect 30 Degrees B—Ordinary Heating Effect 25 degrees
Inside Temperature Taken with Draper's Recording Thermometer
Outside Temperature Taken from U. S. Weather Bureau Records

developed mechanical appliances have been produced and used simultaneously with the introduction of the appliances, but the application of such instruments has not as yet been made to the older art of heating.

It is no uncommon thing to find modern plants equipped with recording instruments for steam boiler and other pressures, temperatures of feed water, refrigerating apparatus and cold storage, temperatures of dry rooms and greenhouses, recording volt, watt and ammeters, revolution recorders for engines, pumps, etc.; and yet it is very seldom that temperatures of buildings are recorded except in a few instances where it is done in connection with automatic temperature regulating appliances.

The design and use of modern steam engines and other power appliances has been brought to its present high efficiency by careful study of the records of indicating and testing instruments and the correct heating of buildings would be very much advanced by the more general use of such instruments as recording thermometers.

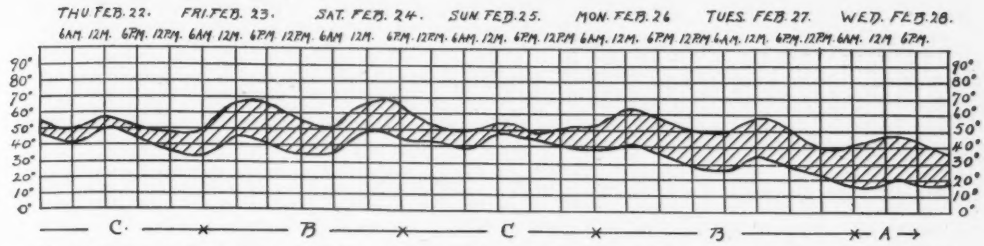
Diagrams produced by the simultaneous records of outside and inside temperatures are more comprehensive in connection with heating than the indicator card is in connection with a steam engine, for the result can be understood and appreciated by those who are in no sense experts. Records of the temperatures of buildings have, of course, often been made and presented in the form of hourly observations of thermometers, but these have seldom covered any very extended periods and have not usually included other than the hours of occupancy of the building.

The great advantage of recording thermometers is in the continuity and completeness of the record; in that it is very important to know what the temperatures have been during the hours of non-occupancy of the building.

A very careful study has been made of the heat losses from buildings and the amount of heat supplied by different forms of apparatus in order that correct methods of proportioning heating appliances might be obtained and if the results were afterward carefully checked up by proper observations with a recording thermometer a great improvement would be made in the methods of estimating.

As the amount of heat given off by radiating surfaces is very accurately known, if a recording thermometer is placed in the building and its record studied in connection with the outside temperature, the heat losses from that building may be very closely figured. If proper observations are made upon the force and direction of the wind, its effect upon air leakage may also be very closely ascertained and properly provided for.

It was the purpose of the following test to ascertain as accurately as possible the result produced by the heating apparatus and use this data in figuring the additional amount of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90° 80° 70° 60° 50° 40° 30° 20° 10° 0°
C B C B A

HEATING CHART IN FACTORY BUILDING SHOWING FLUCTUATIONS IN OUTSIDE AND INSIDE TEMPERATURES

Maximum Outside Temperature 59 degrees
Maximum Inside Temperature 72 degrees
Minimum Outside Temperature 15 degrees
Minimum Inside Temperature 38 degrees

surface necessary to supply the required heat.

The plant was in a one-story building, 600 feet long, 100 feet wide and about 75 feet high to the peak of the monitor roof.

A Draper recording thermometer, after careful calibration, was placed in the building on February 15 and removed on March 7, 1906. The record after February 28 is not shown, as the weather was mild and it is practically a duplicate of the central portion of the diagram.

The periods marked *A*, from 6 A. M., February 15, to 6 P. M., February 16, and from 6 A. M. to 6 P. M., February 28, are those in which the maximum heating effect of the apparatus was obtained with steam at about 8 pounds pressure. In the first period the outside temperature was as low as 15 degrees, and in the second, 16 degrees. The temperature was maintained inside 30 degrees above that outside, and as the outside temperature increased the inside raised correspondingly.

The periods marked *B* are those in which a somewhat lower pressure of steam was used, 2 to 3 pounds, and during these runs the inside temperature was maintained 25 degrees above that outside.

The periods marked *C* are a holiday and Sundays, during which time little or no steam was used in the apparatus.

The lowest inside temperature observed during working hours was 43 degrees in the forenoon of February 28, when the temperature outside was 16.

During the two cold periods the wind varied from west to north and had a velocity of from 15 to 30 miles per hour. If this velocity had been higher it is doubtful if as good a result would have been obtained.

Theoretically the heating apparatus should have raised the temperature a greater amount above that outside when the outside temperature was lower, due to the increased heating effect of the radiating surface. It is an interesting fact to note that the increased air leakage into the building, caused by the greater velocity of the wind, offset this and made the actual heating effect of the apparatus uniform through quite a variation in outside temperature.

There was about 6,000 square feet of radiation in the part of the building under observation and, assuming that it was capable of maintaining the inside temperature at 25 degrees when the outside was zero with steam nominally at atmospheric pressure, it would transmit 2,550,000 B. T. U. per hour, rating the radiation at 425 B. T. U. per hour at 185 degrees difference in temperature.

Taking this as the heat losses of the building at 25 degrees difference and as the heat losses are directly proportional to the difference in temperature, multiplying it by 2.4 the heat loss would be 6,120,000 B. T. U. for 60 degrees difference. Dividing this by 330, the transmission per square feet at 150 degrees difference between the steam and the air, 18,545 square feet of radiation would be necessary to maintain a temperature of 60 degrees inside with zero outside.

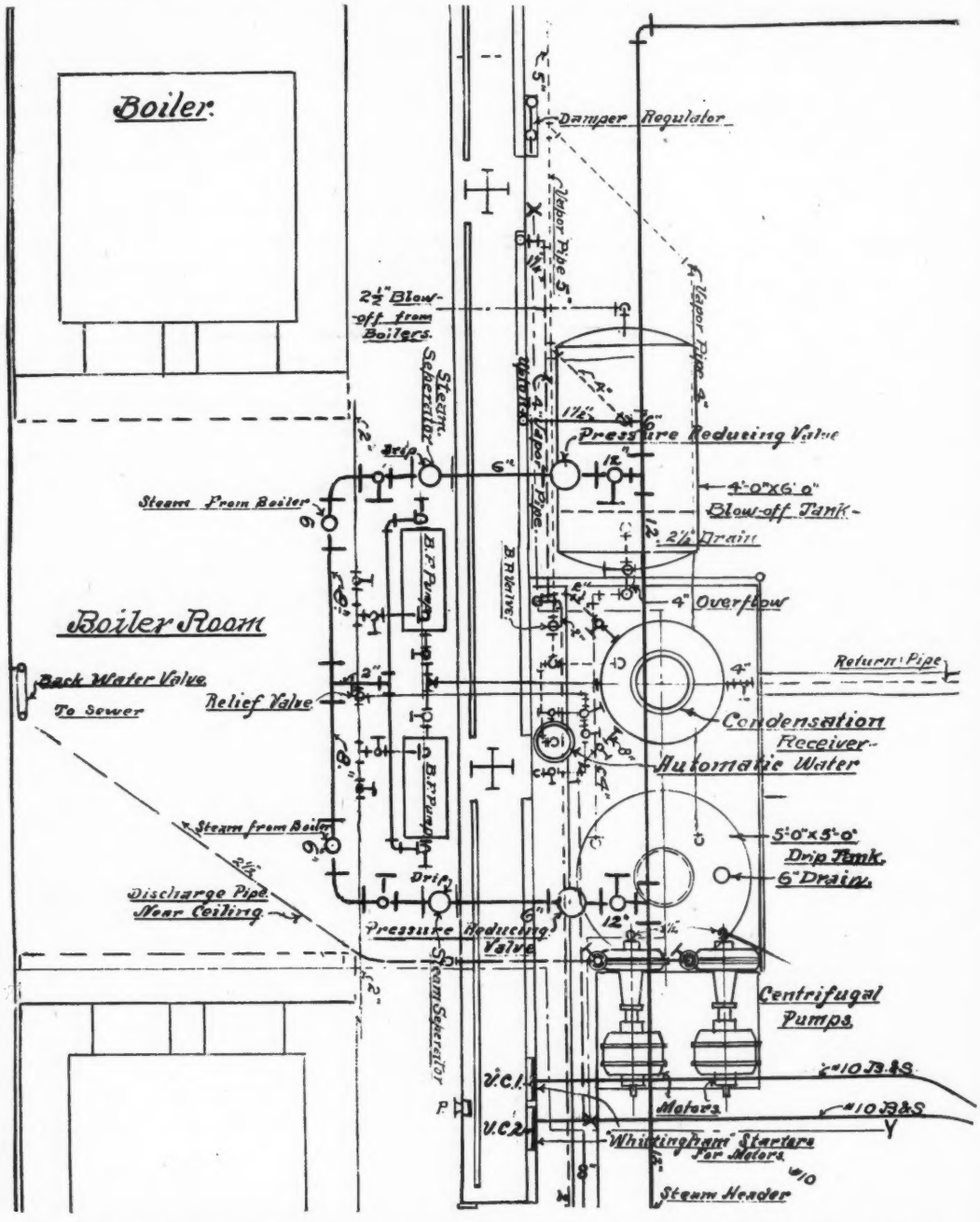
JAMES A. DONNELLY.

# Mechanical Equipment of the New Amsterdam Theater, New York

### Another Type of Upward Ventilation

The building containing the New Amsterdam Theater, in New York, is also an office building, but it is the purpose of this article to describe only the arrangements for heating and ventilating the theater proper. The basement plans of the ventilating apparatus, however, show the locations of the fans and stacks for the offices as well as for the theater.

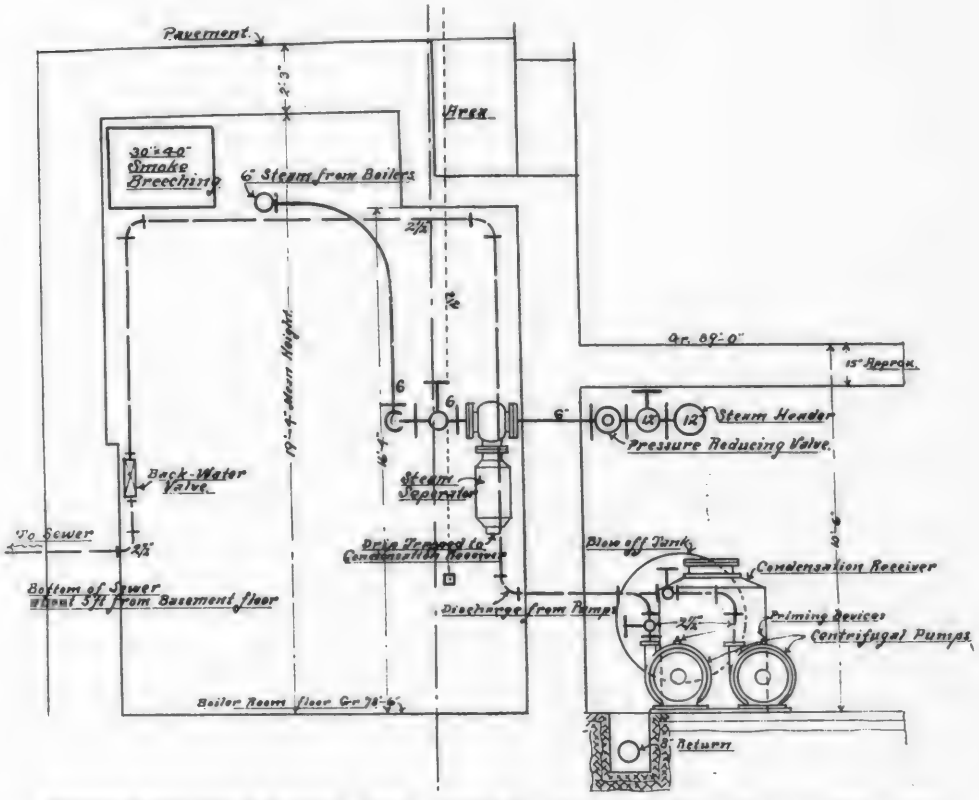
The main auditorium, foyers, New Amsterdam room and other basement




PLAN OF BOILER CONNECTIONS IN SUB-BASEMENT, NEW AMSTERDAM THEATER

rooms are warmed and ventilated by the plenum system, assisted by the exhaust system. The stage of the main theater, the roof garden theater and auditorium, all dressing rooms are heated by direct radiation only. Direct radiation is also used for the heating of the entrances to the main theater.

The fresh air intake is located directly above the porte-cochêre over the main entrance and the air is conducted thence down to an air chamber, the main auditorium through specially-made openings in the floors. Fresh air for the balcony is also taken from the main plenum chamber. All intakes for the subdivided plenum chambers are provided with regulating dampers. A circulating system is also arranged for the main auditorium for warming up the theater previous to its use. The vitiated air chamber for both the theater and office building is located above the auditorium.




SECTION THROUGH BOILER ROOM, SHOWING RELATIVE HEIGHTS OF PIPE LINES

where it passes through air filters and is forced by means of centrifugal fans over radiating surfaces and into a main plenum chamber below the main auditorium. As already stated, a portion of the air from the main air chamber is forced by a separate fan into a separate system of ducts leading to the office building.

From the main plenum chamber the fresh warmed air for the first floor is conducted in subdivided auxiliary plenum chambers and introduced into

The building is equipped with high pressure boilers, and the steam for the heating system passes through reducing valves. The condensation from the heating system is returned to the boilers by means of pumps.

The piping for the indirect and direct radiation throughout the building is subdivided into separate sections, one for the indirect radiation, one for direct radiation to the dressing rooms, one for the stage, one for the office building and one

for the roof garden theater, so that each section can be controlled independently of the other.

Two 250 H. P. water tube boilers furnish the steam for the plant. They are arranged singly. A blow-off tank 4 feet in diameter and 6 feet long is located as shown in the illustration and a drip tank 5 feet in diameter by 5 feet deep is placed in a pit in the engine room. The top of the drip tank was placed flush with the floor of the pit, so that the drip pipe connections, etc., could be made to

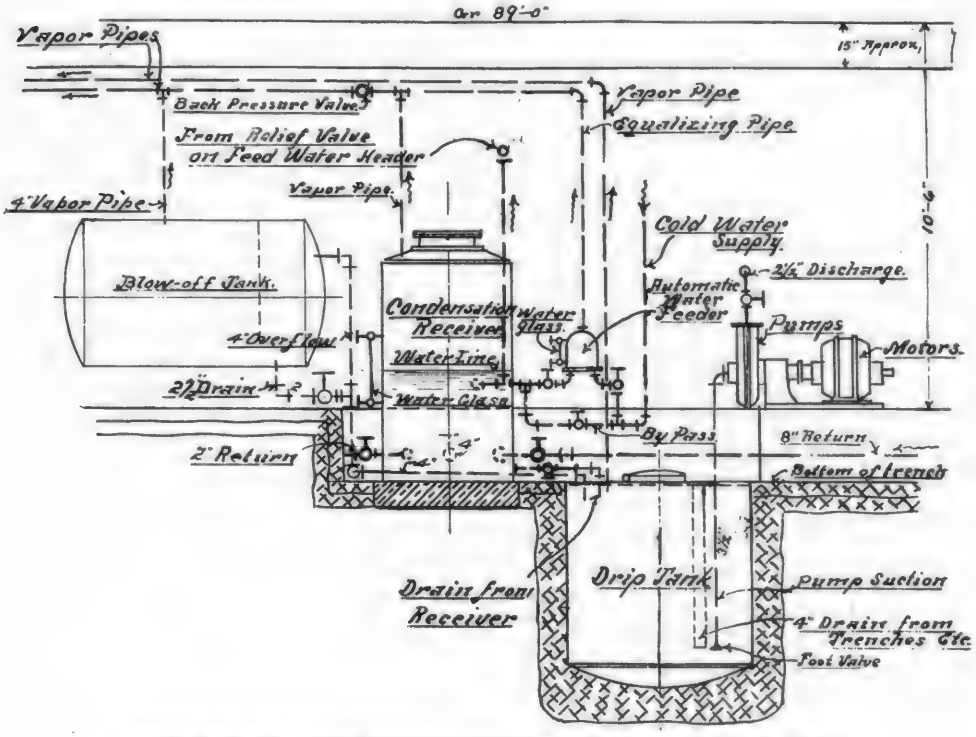
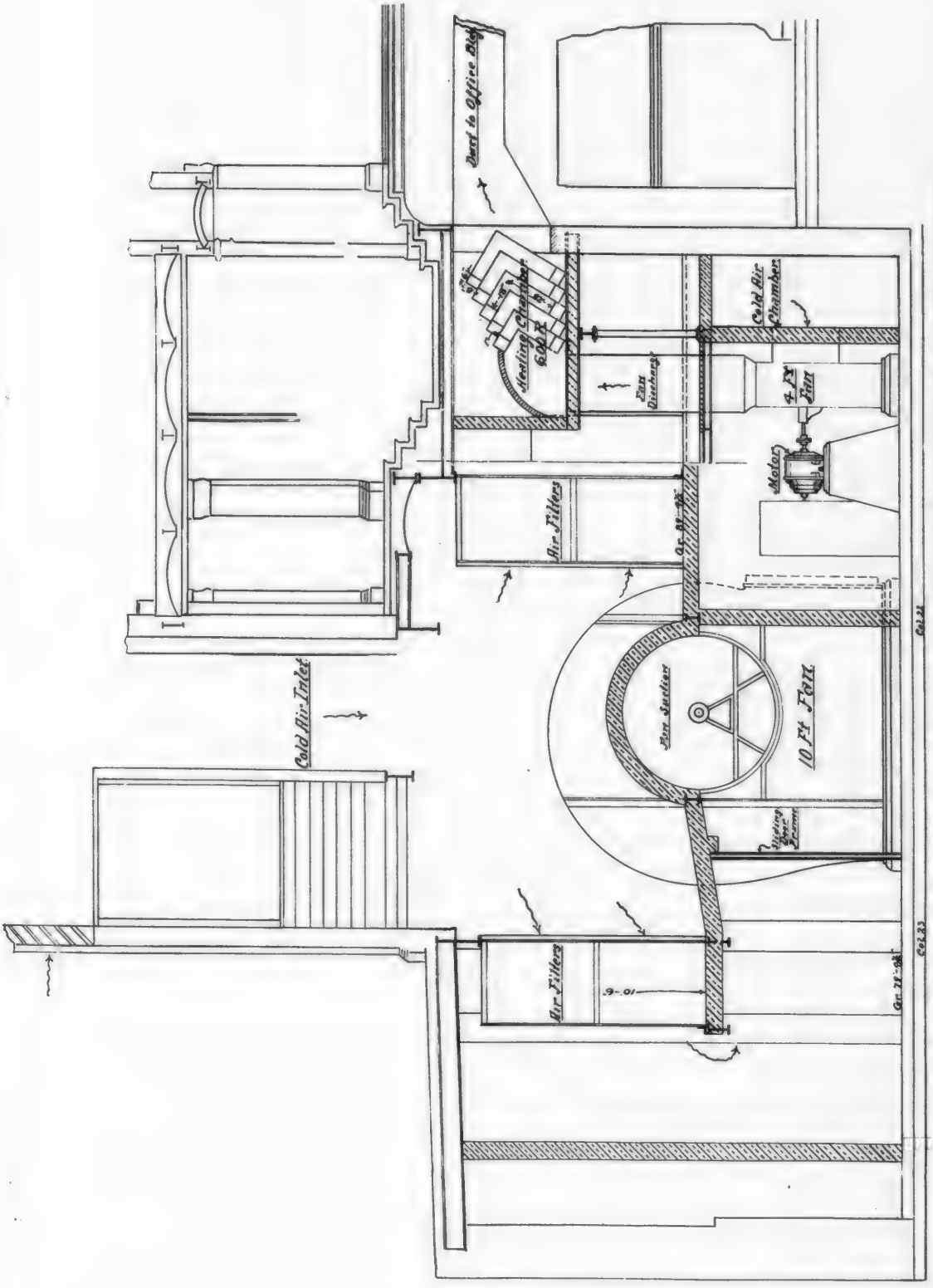



DIAGRAM OF CONNECTIONS FROM RECEIVER, DRIP TANK, ETC.

the top of the tank and the trenches drained into it as shown.

The condensation receiver is 3 feet 6 inches in diameter and 5 feet 6 inches high. The tank is placed in a pit in the engine room two feet deep, and is connected to two boiler feed pumps by a 3-inch suction pipe. The discharge of the pumps is connected to one main feed heater. Relief valves are provided to prevent any undue increase of pressure at any time in the feed water main, and any deficiency in the feed water supply to boilers is made up automatically by means of an automatic water feeder. Care was taken to place the back pressure valve on the vent pipe from the condensation tank in an accessible position, as this valve regulates the pressure carried in the heating system as well as the circulation of the steam by establishing any degree of pressure difference between the extreme ends of the heating apparatus.

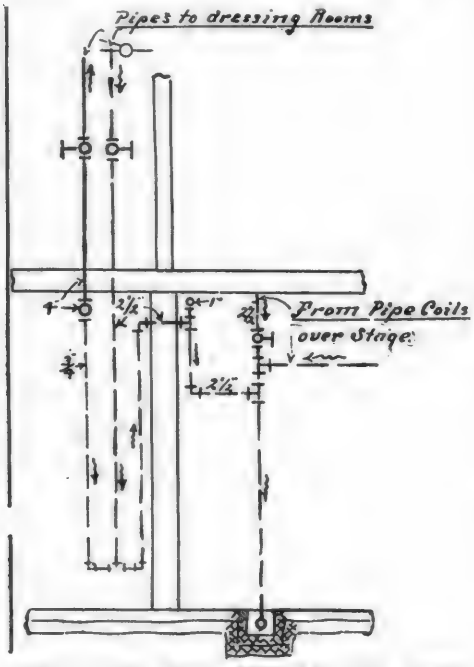
There are two boiler feed pumps 6 x 4 x 6 inches, Duplex, and two electric house pumps, single acting, triple plunger, operated by direct attached electric motors. The house pumps are designed to deliver 180 gallons per minute when operating at 45 revolutions and delivering the water against a pressure of 100 pounds. There is also a horizontal centrifugal pump automatically controlled, with direct attached electric motor, this pump having a delivering capacity of 175 gallons per minute with a lift of 16 feet, including a suction lift of about 8 feet. The pump was arranged so that the bottom horizontal dis-




SECTION THROUGH FAN CHAMBER, SHOWING ALSO VENTILATING APPARATUS FOR OFFICE BUILDING

charge could be continued under the floor of the boiler room. A steel pressure tank for the water supply of the building was also included in the heating and ventilating contract. This tank is 4 feet in diameter and 8 feet high and is located in the pump room between the pumps.

A hot water heater, of 500 gallons capacity, is located in the engine room over the blow-off tank and is there connected to the heating apparatus. The heater is 3 feet in diameter and 6 feet long and the heating surface is properly arranged so that the low pressure or exhaust steam, used for




DETAIL SHOWING RETURN AND DRIP CONNECTIONS TO RISERS OVER STAGE

that purpose, will enter the heater at the highest point of the pipe heating surface and the condensation will be taken off at the lowest point and at the same time allow a perfect drainage of the condensation through all the pipes.

ARRANGEMENT OF INDIRECT RADIATION

There are three sets of indirect radiators. One set warms the air supply to the main auditorium and contains an aggregate amount of 4,300 square feet of pipe surface.

Another set contains 600 square feet of surface and is used to preheat the air supply to the office building. The third set contains 500 square feet of surface for reheating the air supply to the vestibule of the main lobby on first floor of office building.

All heaters consist of five sections arranged as shown, and each section is made of 1-inch pipe, arranged in four rows to each section, spaced 2¼ inches on centers and staggered.

The boilers deliver the steam at a pressure of approximately 40 pounds into an 8-inch header, which at its two ends is continued as 6-inch pipes into the engine room. There each end is provided with a steam separator and pressure reducing valve between the stop valves and connected to a 12-inch low pressure steam header from which the various systems of distributing pipes are supplied.

While the radiators on the first floor, as a rule, are supplied from below, the direct radiators on the other floors are supplied from risers which receive the steam from overhead. Direct radiators in the office building are connected on the two pipe system, but the radiators in the various dressing rooms, with few exceptions, are connected on the one pipe system.

The indirect radiators, however, are all connected on the two-pipe system. The return main terminates, as shown, in the engine room, where it connects to the condensation receiver.

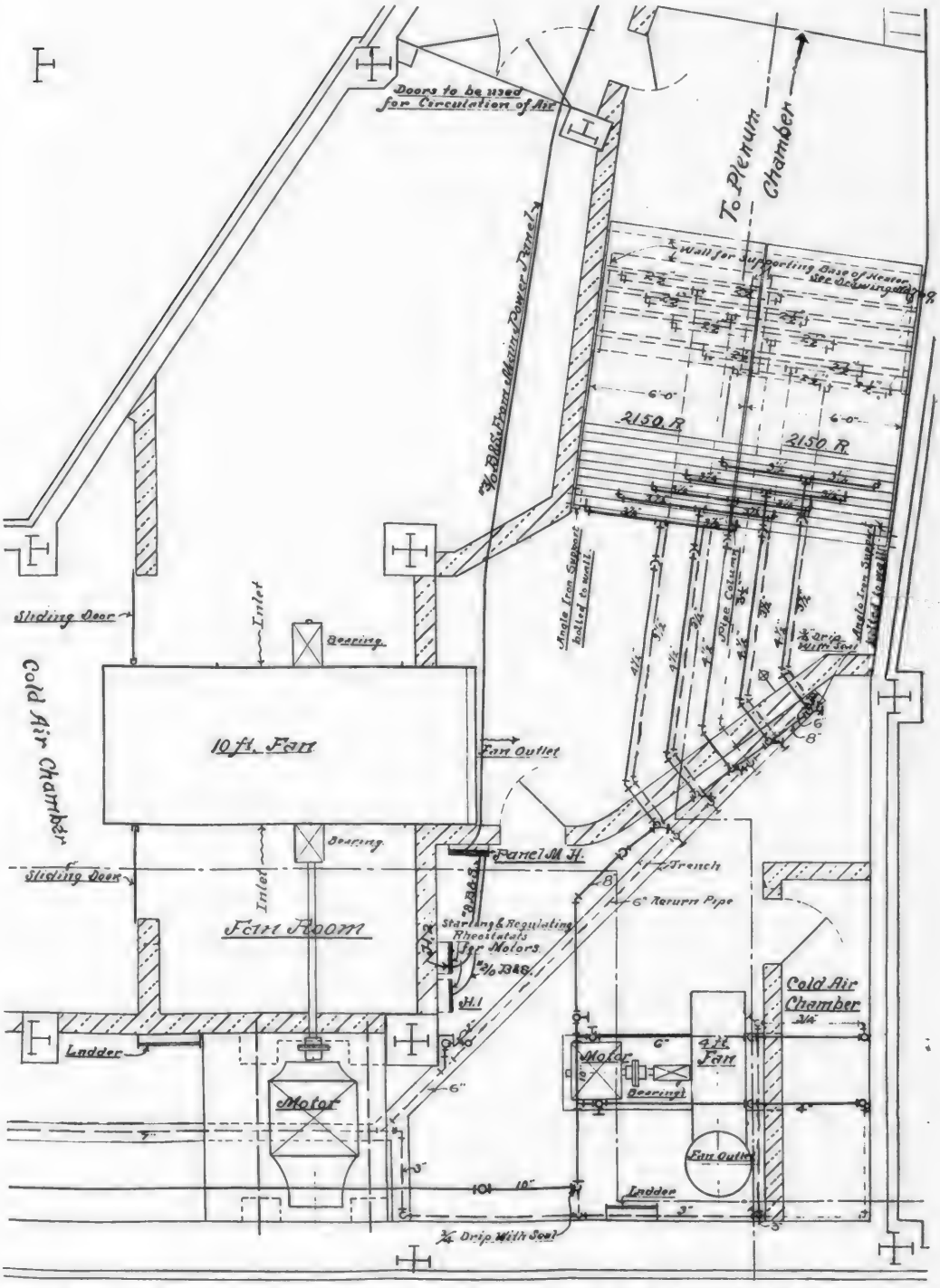
All other connections, except the water supply to the house pumps, and from house pumps to pressure tank, may be noted in the illustrations.

PIPE TRENCHES.

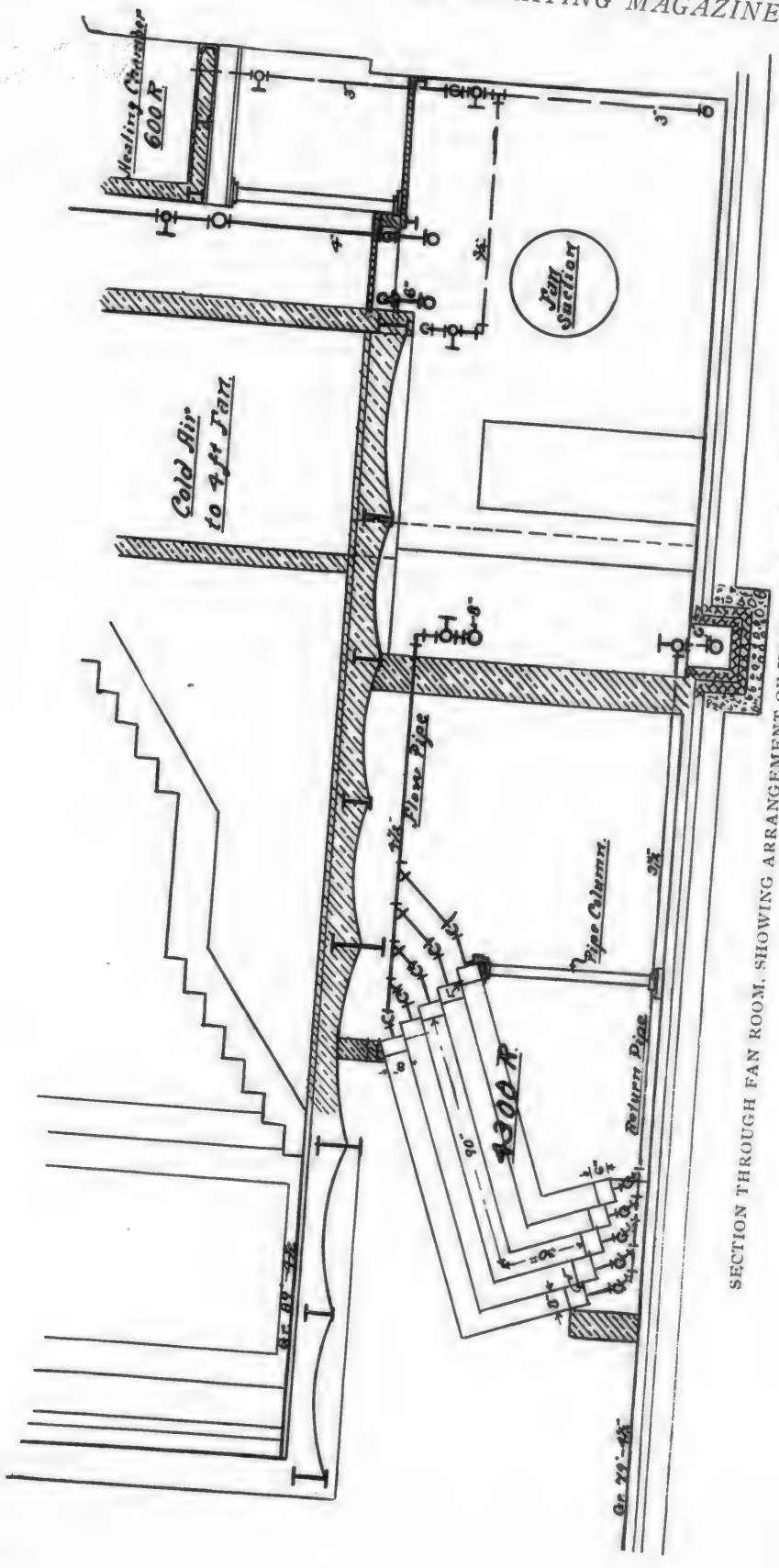
An interesting feature of the plant are the pipe trenches, which run below the sub-basement floor level. These trenches are built of concrete 6 inches thick and plastered inside with cement ½ inch thick. They are covered with cast iron plates. The pipes in the trenches are supported on expansion rollers and chairs every eight to ten feet.

THE FANS.

For the supply of air to the main



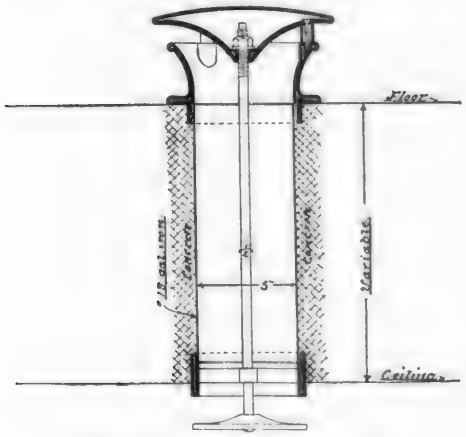

PLAN OF VENTILATING APPARATUS IN SUB-BASEMENT, NEW AMSTERDAM THEATER




SECTION THROUGH FAN ROOM, SHOWING ARRANGEMENT OF HEATERS AND PIPE CONNECTIONS

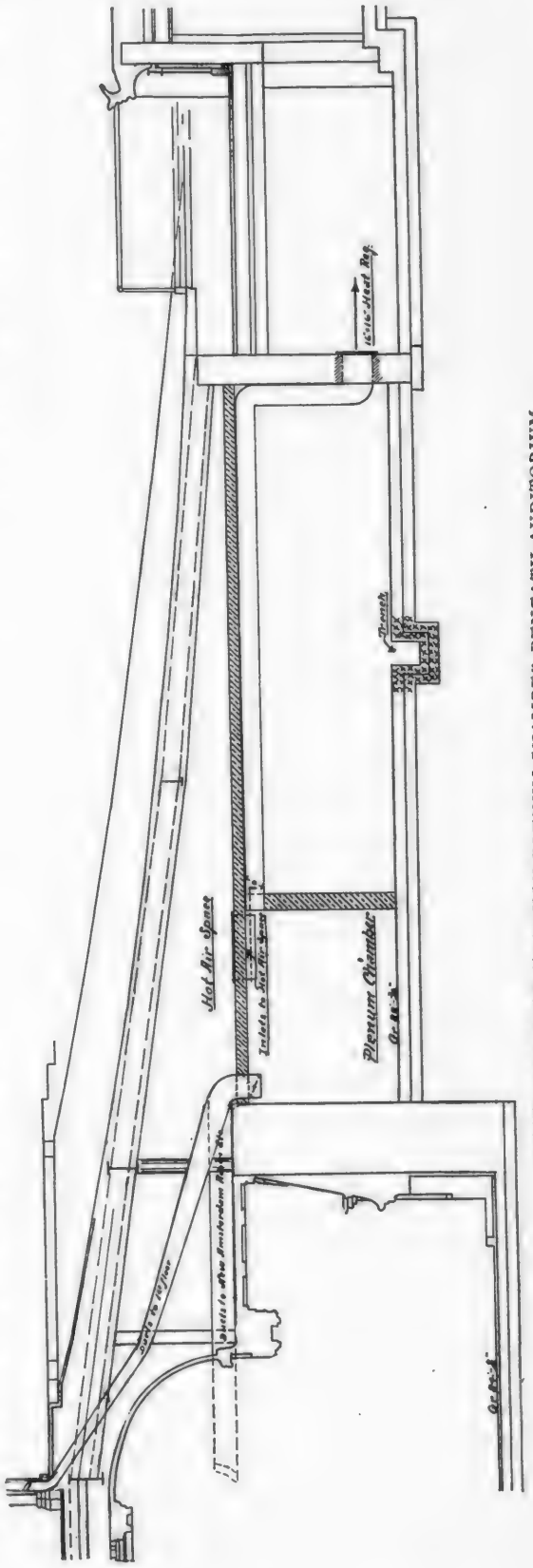
auditorium an extra wide centrifugal fan is provided with a fan wheel 10 feet in diameter, and capable of delivering 40,000 cubic feet of air per minute when running at 150 revolutions per minute. The office building fan is 4 feet in diameter and furnishes 5,000 cubic feet per minute when running at 350 revolutions per minute.

In the construction of the main plenum chamber the walls were made of brick, 9 inches thick, and the entire inner and outer wall surfaces plastered 5/8 inches thick. The ceiling of the main plenum chamber also forms part of the flooring for the center auxiliary plenum chambers and as such is extended to the circular wall of the orchestra pit and at the




DETAIL OF AIR INLET TO AUDITORIUM

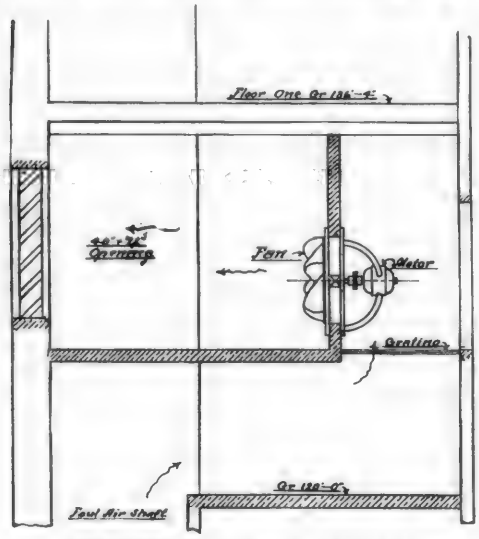
sides. This flooring is made of 4-inch I-beams hung from beam framing of the first floor construction, braced to each other, and filled in and plastered on top and bottom with cement. Partitions between the various auxiliary plenum chambers are constructed in a similar manner of expanded metal secured to iron uprights which at the same time are used as hangers for the beam construction of the floor, and plastered on both sides with cement. This construction is described in detail as it was, of course, essential to provide an air-tight compartment. A number of doors and manholes were provided to admit of access to all parts of the chamber.




SECTIONAL VIEW THROUGH PLENUM CHAMBER BENEATH AUDITORIUM

EXHAUST FANS.

Two exhaust disk fans serve to remove the foul air from the main auditorium and basement of office building. Each fan is built to deliver 62,500 cubic feet of air at free discharge at a speed of 300 revolutions per minute. There is a third 42-inch exhaust disk fan for the removal of foul air from the pit under the stage and certain basement rooms in the main building. All of the exhaust fans are directly connected to electric motors.




SECTIONAL VIEW OF EXHAUST FAN CHAMBER

The theater is provided with a telethermometer system indicating the temperature in the various parts of the main theatre. Two indicating stations are arranged, one in the manager's office in the basement of the office building and one in the pump room of the sub-basement. These indicating stations are connected with two thermometers on the first floor, one thermometer near the stage, one in the rear part of the auditorium, one in the rear of the balcony, one in the rear part of the gallery and two on the stage.

The heating and ventilating plans for this theater were drawn by Adams & Schwab, consulting engineers, of Baltimore.

## *Estimate Forms for Heating and Ventilating Work*

All heating and ventilating engineers have their more or less distinctive methods of figuring the requirements and capacity of the work they design. These methods range all the way from the rule of thumb to elaborate estimating rules, based throughout on thoroughly scientific principles.

It used to be said of at least one successful engineer that he never put a pencil to paper in estimating his work, but would give a shrewd guess of its cost, based upon a casual inspection of the building plans, that would usually come remarkably close to the carefully-figured estimates of his competitors.

This course, however, is hardly a safe one to follow, and while the rule of thumb still guides many engineers

| NO. | ROOM | CUBIC CONTENTS | TRANSMISSION OF HEAT | PER CENT ADD | TOTAL HEAT TO BE SUPPLIED | HEATING SURFACE | | NOTES |
|---|---|---|---|---|---|---|---|---|
| | | | | | | FIGURED RATIO | ACTUAL RATIO | |
| | | | | | | | | |

FORM FOR DIRECT RADIATION ESTIMATES

| NO. | ROOM | CUBIC CONTENTS | FRESH AIR SUPPLY | | | | | | | | | FOUL AIR EXHAUST | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CHANGE PER H. | AIR SUPPLY PER MINUTE | DUCTS AREA | DUCTS SIZE | FLUES AREA | FLUES SIZE | REGISTERS AREA | REGISTERS SIZE | NOTES | CHANGE PER H. | EXHAUST PER MINUTE | DUCTS AREA | DUCTS SIZE | FLUES AREA | FLUES SIZE | REGISTERS AREA | REGISTERS SIZE | NOTES |
| | | | | | | | | | | | | | | | | | | | | |

FORM FOR VENTILATION ESTIMATES

| NO. | ROOM | CUBIC CONTENTS | B. T. U. WITH ALLOWANCE | DIRECT HEATING SQ. FT. RAD. | INDIRECT HEATING | | | | | | VENTILATION | | | | | | | NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | AIR SUPPLY | | | AIR EXHAUST | | | | |
| | | | | | CU. FT. AIR AT | CHANGE PER H. | AIR SUPPLY PER MINUTE | VEL. IN FLUE | FLUE AREA | SQ. FT. STACK | CHANGE PER H. | AIR SUPPLY PER MINUTE | FLUE AREA | CHANGE PER H. | AIR EXHAUST PER MINUTE | VEL. IN FLUE | FLUE AREA | |
| | | | | | | | | | | | | | | | | | | |

FORM FOR INDIRECT HEATING AND VENTILATION ESTIMATES

| NO. | ROOM | DIFF. TEMP. | TRANSMITTING SURFACE | | | COEFF. | HEAT UNITS | NOTES |
|---|---|---|---|---|---|---|---|---|
| | | | KIND | SIZE | AREA | | | |
| | | | | | | | | |

FORM FOR DIRECT RADIATION ESTIMATES

in figuring out their estimates, giving results that they themselves cannot satisfactorily explain, still the practice generally is towards more scientific methods, and in this connection the accompanying estimate blanks should prove interesting.

The forms are the outgrowth of many years' experience in the estimating room and are compiled in a way that renders them very convenient, both for use and for reference. They are the forms used in the office of Mr. Alfred R. Wolff, of New York, by whose courtesy they are reproduced.

---

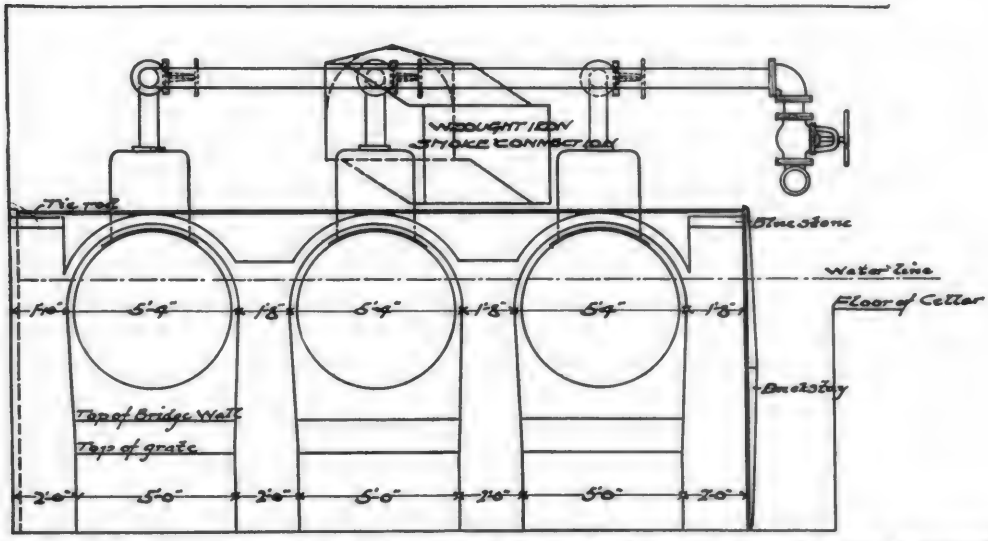
# *Heating and Ventilating a Court House Building*

***Union County Court House, Elizabeth, New Jersey***

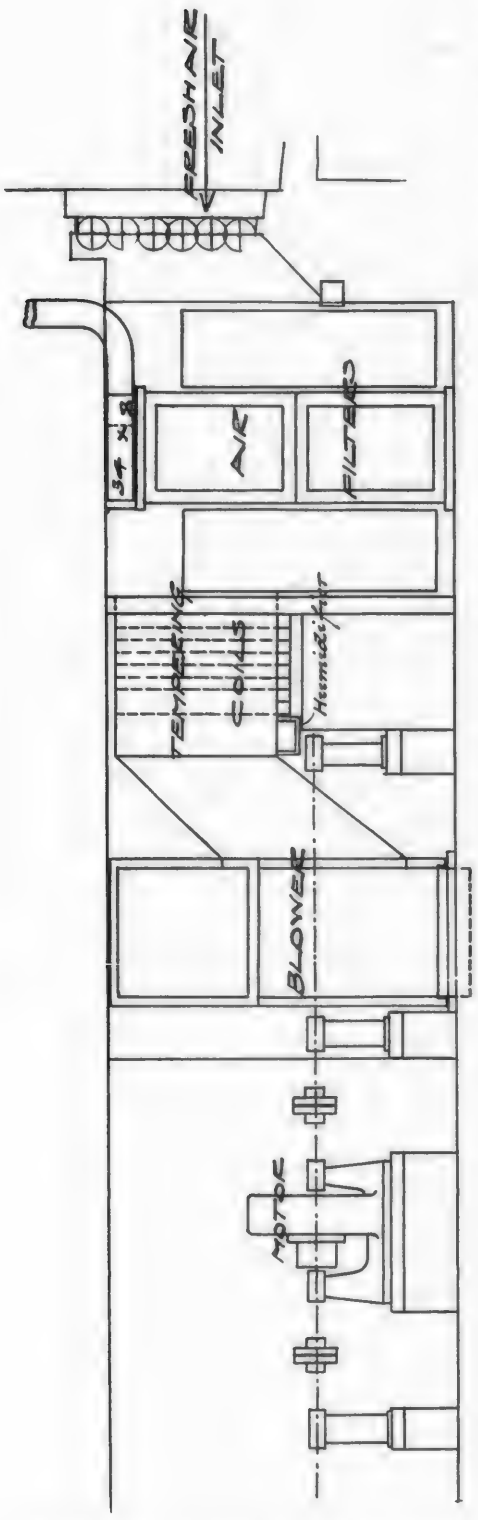
PIPING PROBLEMS IN PUBLIC BUILDINGS—II

[EDITOR'S NOTE.—The second of a series of articles dealing with illustrations of the various methods adopted for heating and ventilating buildings devoted to public use.]

Elizabeth, New Jersey, with its new court house, boasts of one of the finest public buildings in the state, and its mechanical equipment includes a carefully planned heating and ventilating plant. The system, as adopted, is designed to heat the building by means of direct radiation and an auxiliary supply of tempered air is furnished for ventilating purposes. The ventilating arrangements, however, are very complete and all the




SECTION THROUGH BOILERS IN FRONT OF BRIDGE WALL, UNION COUNTY COURT HOUSE




ELEVATION OF ONE OF THE BLOWERS, TEMPERING COILS, ETC., FOR UNION COUNTY COURT HOUSE

principal rooms in the building have their supply of fresh air as well as their exhaust of vitiated air. The system is operated by three boilers of the horizontal return tubular type, 60 inches in diameter and 16 feet long. The boilers are designed to carry working pressure of 90 pounds per square inch. The blow-off tank, 3 feet in diameter and 7 feet long, is located at the point shown in the illustration and is connected to the sewer. A hand pump is utilized in lifting the water from the tank into the sewer. A cesspool in the fireroom is connected to the same pump.

### HEATING SYSTEM

The steam piping is arranged so as to secure the return of all the water of condensation to the boiler by gravity. The horizontal return mains are run below the water level in the boiler, obtaining a sealed return from each branch from the risers and all dry returns at the ceilings from separate branches are run separately from a point below the water level.

The sizes of the horizontal mains and returns are as noted on the illustration of the basement plans. A schedule of the connections to radiators is as follows:

1 inch steam pipe and 1 inch return pipe up to 36 square feet.

1¼ inch steam pipe and 1 inch return pipe up to 72 square feet.

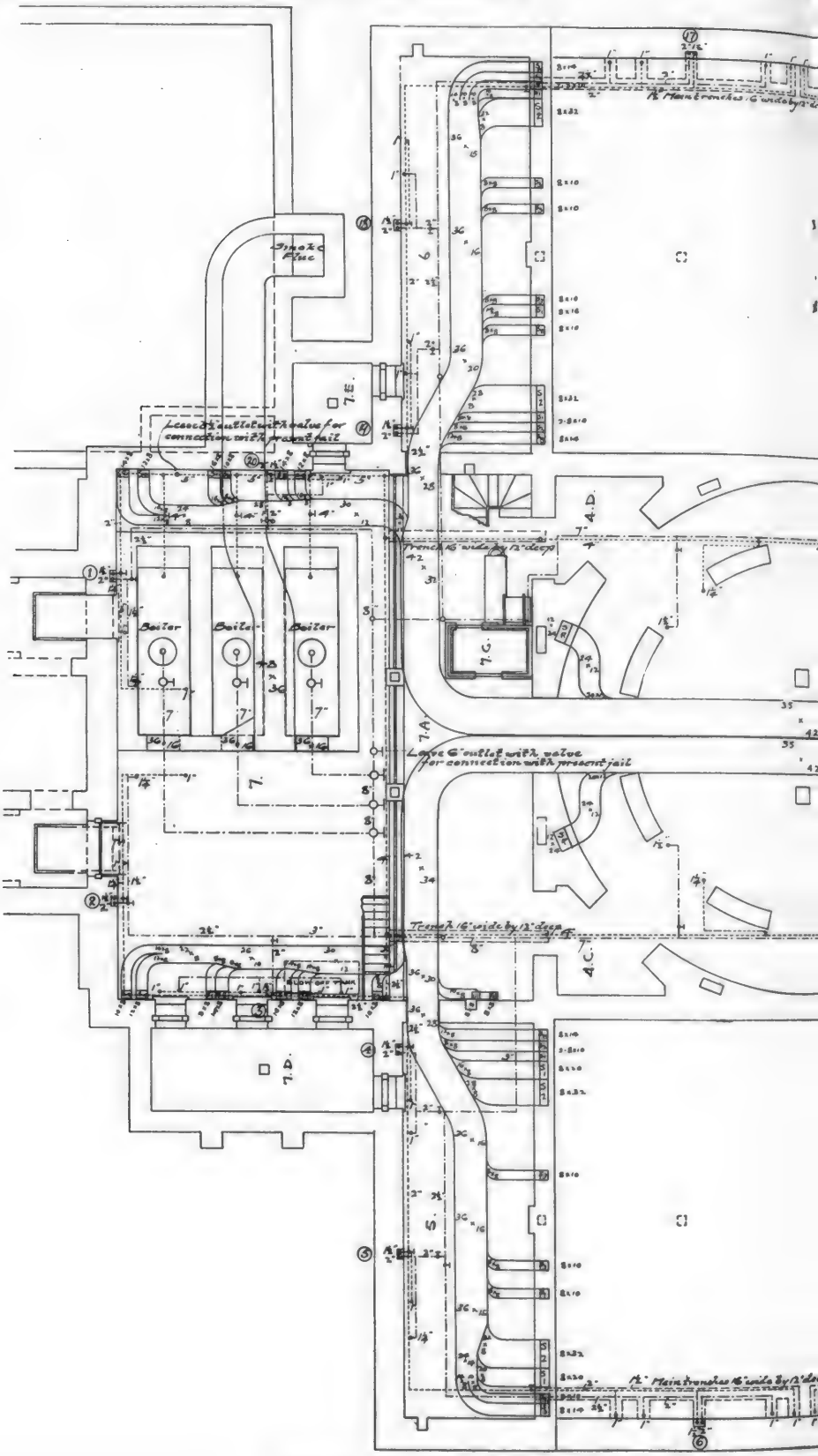
1½ inch steam pipe and 1¼ inch return pipe up to 120 square feet.

2 inch steam pipe and 1½ inch return pipe up to 280 square feet.

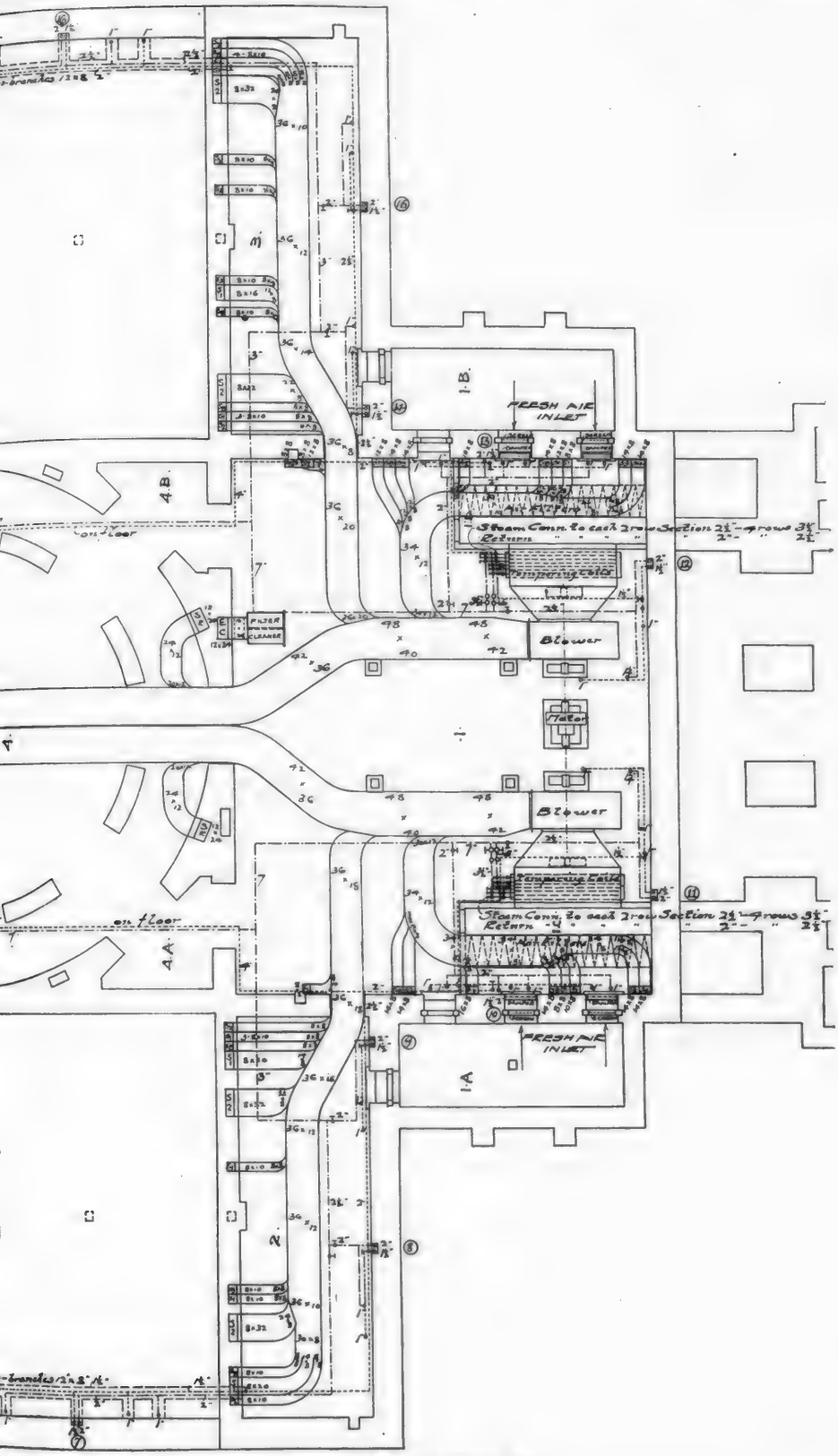
### VENTILATING SYSTEM

In connection with the ventilating system, an air moistening apparatus was installed consisting of two humidifiers, placed inside of the tempering coil casings. Each apparatus consists of an evaporating pan of copper, fitted into the bottom of the connection between the tempering coils and blowers and provided with a steam coil of brass pipe, placed in the bottom of the pan.

The evaporating is controlled by humidostats located in the tempered air ducts and operating the return and supply valve on the steam coil




PLAN OF HEATING AND VENTILATING APPARATUS IN C




LLAR OF UNION COUNTY COURT HOUSE, ELIZABETH, N. J.

in such a manner as to obtain the desired percentage of moisture in the air supply. The pans are provided with automatic water feeders with float valves, etc. The compressed air lines for the humidostats forms part of the thermostat system.

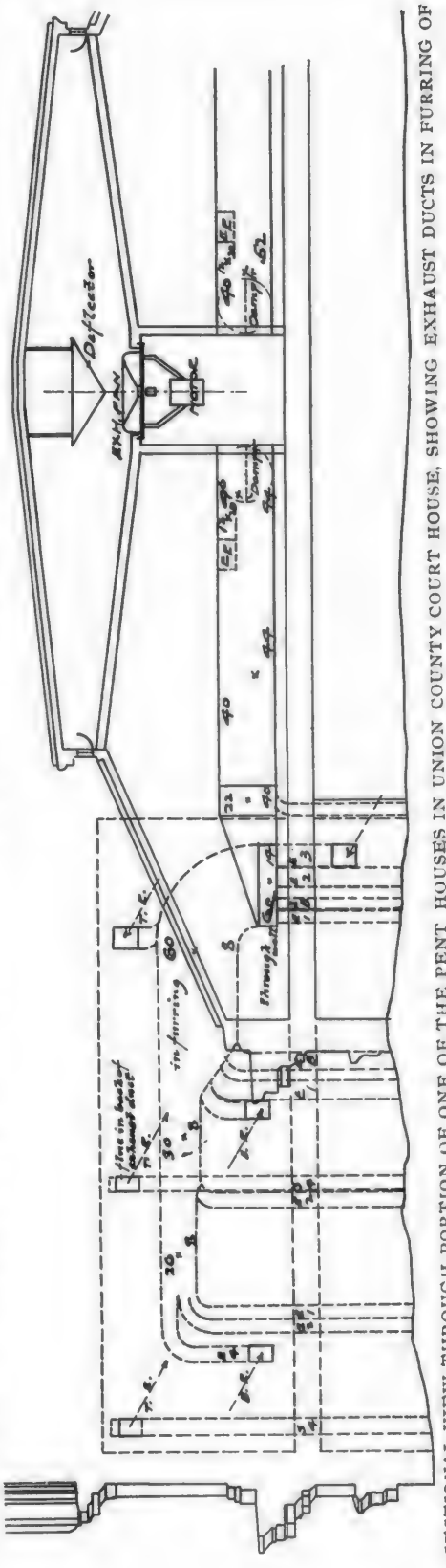
The ventilating apparatus proper provides for fresh air supply and exhaust for the principal rooms in the building, by means of fans operated in connection with the tempering coils and by exhaust fans in the attic. There are two fans in the basement, with blast wheels 6 feet in diameter by 3 feet 6 inches wide and coupled together with a motor between them. The fan wheels have curved blades and the blowers themselves are encased in full steel plate housings. This arrangement separates the ventilating system into two equal sections.

The tempering coils contain 1,100 square feet of heating surface in single sections 10 feet wide by 4 feet high, made of 1 inch pipes screwed into separate headers on the steam and return ends, thus securing a positive circulation of steam. There are five sections of two rows each and one of four rows each, making the coils 14 rows deep. The coils are encased in a steel plate jacket, extending from the cold air chamber to and around the coils and connecting with the inlets of the blowers. Doors are provided on the sides of the casings for gaining access to the pipes. The tempering coils are purposely located high to insure the return of all water of condensation by gravity.

The motor which drives both fans is of the slow speed, multipolar type, provided with flexible flanged couplings on both ends for connection with the fans shafts. The motor has three different speeds, ranging from 120 to 200 revolutions per minute and developing 16 H. P. at the top speed.

The two exhaust fans in the attic are 60-inch Blackman, fitted with direct connected electric motors with vertical shaft. These motors are run at three different speeds, ranging from 150 up to 250 revolutions per minute.

The duct work in the basement is generally above the steam piping, and




SECTIONAL VIEW THROUGH PORTION OF ONE OF THE PENT HOUSES IN UNION COUNTY COURT HOUSE, SHOWING EXHAUST DUCTS IN FURRING OF FOURTH FLOOR

care was taken to avoid the passing of steam in other pipes through the ducts. Every branch duct leading to and from individual flues has its damper, in addition to those in the main ducts. Generally the bottoms of the air supply registers are not less than 10 feet above the floor level. The exhaust registers are placed both near the ceiling and near the floor.

The filtering of the air is taken care of by means of an apparatus consisting of wooden frames, inserted in heavy galvanized iron frame work, with galvanized wire netting covered with cheese cloth. There are two air filters, each having a total filter area of 65 square feet. A cleaning hopper for the air filters is located and connected as shown in the illustration.

ARRANGEMENT OF THERMOSTATS

The entire system is thermostatically regulated by 63 thermostats controlling 120 heat sources and two pneumatic valves controlling four heat sources. In the cellar there are two cold air thermostats in control of the outside sections of each tempering coil and two hot air thermostats controlling the inside temperature of each coil. The direct heating surfaces in rooms are controlled by diaphragm valves on both the steam and return ends of radiators.

The three inside sections of each tempering coil are controlled by a hot air thermostat, placed in the tempered air duct, automatically operating diaphragm valves on steam and return pipes. The three outside sections of each coil are also controlled by a cold air thermostat located in the fresh air inlet, automatically shutting off the diaphragm valve on steam and return pipes.

Again, the three outside sections of each coil are controlled by a cold air thermostat, located in the fresh air inlet, automatically shutting off the diaphragm valves on steam and return pipes, when the incoming air rises to a certain degree and opening the valves when the fresh air temperature drops below this degree, thus securing a continuous heating effect from these sections when required.

The steam and return valves on the coils in the skylight are connected with a system of compressed air lines, provided with switches for hand control.

The system was designed by Mr. Alfred R. Wolff, consulting engineer, of New York, and was installed by Blake & Wiliams, of New York.

### Concrete Tunnels for Steam Pipe

In response to numerous comments on the method adopted for carrying steam

VIEW OF PIPE TUNNEL ON PROPERTY OF CATHEDRAL CORPORATION, GARDEN CITY, L. I., DURING PROCESS OF CONSTRUCTION

pipes through tunnels, as described in our last issue, in connection with the plant at Garden City, Long Island, we take pleasure in presenting herewith a photograph of the tunnel in question during the process of construction. The illustration shows both the method of constructing the tunnel of Portland cement concrete, and the arrangement of the piping at one of the junction boxes.

### Where One Bound Volume Will Go

HEATING AND VENTILATING MAGAZINE, 1123 Broadway, New York.

Gentlemen: Your HEATING AND VENTILATING MAGAZINE has come to my notice and seems to be a valuable publication. If I should become a subscriber could you let me have the magazine from the very start?

Yours truly,

Milwaukee, Wis., March 31, 1906.

# The Schoolhouse—Its Heating and Ventilation

By Joseph A. Moore,
Inspector of Public Buildings, State of Massachusetts

## I.—Circulation of Air

[Editor's Note.—Mr. Joseph A. Moore has been engaged for the last nineteen years in the inspection of the public buildings in Massachusetts; in supervising their construction and testing the various methods of heating and ventilation that have been used, especially in schoolhouses. In this article Mr. Moore draws on his own wide experience for facts in connection with the circulation of air, and presents such methods as have proved in actual experience to give satisfactory results. It may be added that Mr. Moore's article is in amplification of many of his ideas as expressed in his work on the subject of schoolhouse heating and ventilation.]

In designing a system of heating and ventilation one of the most important points to consider is the proper circulation of the air used for conveying the heat and also for removing the impurities thrown off by the occupants of the rooms, or from any other source of contamination.

For many years it would seem that very little attention was given to this matter. The only thought apparently was where the inlets and outlets could be most conveniently placed, without regard to their efficiency.

We have seen schoolrooms where the warm air was brought in through a register in the floor and was allowed to escape through a register in the ceiling or side wall near the ceiling and almost over the inlet.

In other cases the inlets and outlets were placed in the outer and most exposed corners of the room, where the fresh air that leaked in around the windows was taken out through the vent ducts, having done nothing but cool the air in the immediate vicinity of the vent duct.

Again, the warm fresh air has been brought in through an inlet properly located, but the outlet being placed directly opposite the inlet, the air would pass across the room and go out at the outlet, doing but very little good; in fact, only causing uncomfortable drafts on whoever had the misfortune to be located between the inlet and the outlet.

In many instances the warm air would be taken in at the inner or warm angle of the room while the outlet was placed near an outside or exposed wall.

Sometimes it would appear that the designer of the system had devised some scheme that would do the work in the most unsatisfactory manner.

### FORMER SYSTEMS

In one "system" that was installed in many school buildings (but which is not at this time allowed in Massachusetts), the outlets were long, narrow openings placed at the floor level in the outside walls and often under the windows. The air was taken across under the floors between the floor timbers and down into what was called a "foul air gathering room," and then passed over screens placed below the seats in the sanitary closets (perhaps the term unsanitary closets would be more appropriate). Here it was supposed to dry the excrement, which was afterwards to be burned by pouring a quantity of oil over it and then setting the oil and accumulated paper on fire.

In such a "system" the air which came into the room around the windows, or was cooled on the glass surface, would drop down to the floor, and, if there was a strong fire in the large heater in the ventilating shaft, after having been passed through the space under the "cremating closets" would be taken out of the building, while the vitiated air, especially in the inner or warm parts of the room occupied by the pupils, would remain.

By chemical tests the writer has many times found the air to be purer in the so-called "foul air gathering room" than about the seats where the pupils were located.

Another serious defect in this "system" was the danger of odors and gases being forced back into the

schoolroom when there was no fire in the vent shaft heater, or where the vent shafts came through the roof in a location to be affected by adverse air currents or wind.

In addition to these defects was the danger from fire. The rough floor timbers and boards soon became covered with fine particles of lint and other material which was drawn in by the air current. If fire from any cause should get into these underfloor ducts it would spread with great rapidity through the entire building.

The Massachusetts law which prohibits wooden ducts for heating and ventilating public buildings soon put a stop to the further extension of this dangerous "system."

Another "system" was introduced into some school buildings, by means of which it was proposed to draw the air down from the upper stories through a duct which entered the bottom of the vent shaft, and which was enlarged at each story as it came down to the basement, where air was to enter the vent shaft and, after being warmed by a "stack heater," or small furnace, was to escape through the central vent shaft.

The opening from the upper story room was supposed to be sufficient to furnish the required ventilation for the room in which it was placed. The duct was enlarged at the next floor below to twice its original size, and so on.

The designer of this "system" did not take into consideration the fact that moving air will follow the line of least resistance. It was often found that, while an anemometer would show a velocity of 500 feet or more per minute at the lower opening, the movement of air at the upper opening was not strong enough to cause any movement of the anemometer wheel.

Several other "systems" were brought forward and introduced by various experimenters, who in many cases tested their theories at the expense of various cities and towns.

### LOCATION OF INLETS AND OUTLETS SHOULD BE VARIED

The writer has found that the best results are obtained by varying the location of the inlets and outlets to meet the different locations of the cold or exposed walls.

In the schoolroom having two cold and exposed walls the inlet should be placed with the lower part about eight feet above the floor (allowing the room to be twelve feet high) and in one of the warm sides, about four or five feet from a cold or exposed wall. The top of the inlet should be curved so as to throw the air forward and across the room to the most exposed or cold angle of the two outer walls, the outlet being placed at the floor level and near the inner or warm angle of the room.

The air, on entering the room through the inlet opening (which should be covered by a grill of about $\frac{1}{8}$-inch wire of diamond mesh pattern, the mesh being about $1\frac{1}{2}$ to 2 inches long at its greatest dimensions, and set in a channel iron frame) passes first forward and upward and speeds across the ceiling to the outer wall of the room, being at the same time drawn toward and down the windows by the cooling effect of the glass surface, continuing around the room with a falling spiral movement, diffusing throughout the room and gradually falling and drawing toward the outlet.

In a room considerably longer than wide and with three exposed or cold walls, the inlets should be placed at the same height above the floor as in the preceding case, but in this case there should be two inlets and one outlet. The inlets should be in the inner or warm wall, about the same distance from the cold end walls as in the first instance. The outlet should be placed at the floor level, but as near as practicable in the center of the inner or warm wall.

The entering air will spread across the ceiling to the cold walls, as in the case of the room with two cold and two warm walls, but a considerable part of the two currents will meet near the center of the longest outside wall and the whole will be drawn down and back to the outlet near the center of the warm wall.

In a room having three cold and one warm wall, but with the warm wall on one end of the room, the inlet should be placed about 8 feet above the floor near the center of the warm wall, and the outlet placed at the floor level, nearly under the inlet. The entering air will spread across the ceiling to the three outside cold walls,

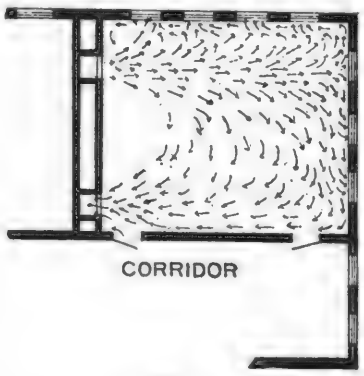



FIG. 1

where it will fall and be drawn back from all sides across the room to the outlet.

In a room having one cold and three warm walls, the inlet and outlet can be placed either as in the first or last mentioned instance. (Figures 1 or 2.) Good results will be obtained either way, and the location can be determined by considering which method will be best adapted to the construction of the building and the general location of other heat and vent ducts.

A volume of air heated from the freezing to the boiling point of water, barometer 30 inches, expands approximately 1/500 (1/490) for each degree F. it is raised.

If the air of a schoolroom is 40 degrees higher than that of the exterior air its volume has been increased approximately 2/25; consequently it is lighter than the exterior air and tends to rise.

A cubic foot of air at 60 degrees F., dew point 40 degrees, barometer 30 inches, will weigh 534.27 grains.

A cubic foot of expired air at 95 degrees F., dew point 85 degrees, containing 12.78 grains of vapor, and, say, 4 per cent. of carbonic acid, will weigh only 494.12 grains, or 7.5 per cent. less. This tendency to rise is further increased by the heat given off by the body, which warms the air in immediate contact with it.

### DISADVANTAGES OF UPWARD VENTILATION

At first sight it would seem easier to ventilate a schoolroom by the general upward movement of the air, because of its tendency to rise when first exhaled from the lungs.

If the air is admitted at the floor and taken out at the ceiling there is established a current between the inlet and the outlet, leaving the foul air in some parts of the room almost unmoved, and only slowly and partly drawn into the current.

Another objection to this method of ventilation is the difficulty of properly heating a schoolroom by it. The great loss of heat necessitated thereby calls for the consumption of a much greater quantity of fuel. The hot air is drawn off rapidly from the top, while the cold air remains at the bottom of the room.

From whatever point the warm fresh air is admitted to the schoolroom, it rises at once to the ceiling,

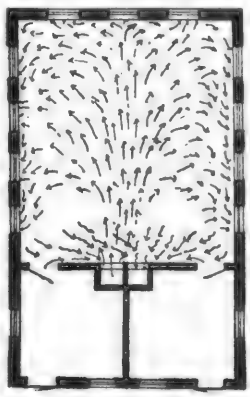


FIG. 2

and the sooner it reaches that point without being contaminated the better it will be.

By the law of diffusion of gases the expired air would in time undoubtedly be diffused throughout the whole room, as would also the poisonous nitrogenous matter exhaled from the lungs and bodies.

By exhausting the foul air from the

bottom a downward movement of the warm air entering at the top of the room is maintained, and as the poisonous products of respiration must be diluted and removed by the introduction of pure air, a circulation within the room is maintained which will produce the required results.

If we make a careful inspection of the course of hot air admitted through a register in the floor we will see that the current of hot air goes directly to the ceiling, and that a portion of the surrounding cooler air is carried up with it by friction, and that this air was drawn from near the floor. The air thus carried up was foul air, and should have been carried off through the vent duct.

The question of admitting the fresh air at the top of the room is not determined by the natural movement of carbonic acid or any other impurity, or by the gravity or weight of the air as it comes from the lungs.

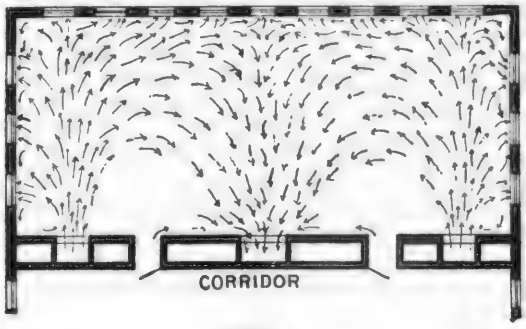



FIG. 3

In cold weather the fresh air must be warmed to a number of degrees above the temperature at which we wish to have the room at the breathing line. Heated air will go to the top of the room, no matter where we admit it, and its distribution will begin there. By leading it there in pipes or flues we avoid carrying up dust and foul air with it, and we can locate the inlets and direct the flow of air so as to distribute it more evenly than if we admit it at the floor. The air will spread over the ceiling and be drawn to the outer walls by the falling current caused by cooling on the windows and walls. It then descends to the floor, and may be best taken out at the bottom of the room.

Wherever there is any attempt at a proper system of ventilation in a schoolhouse, the walls and ceiling should be made as impervious as practicable both to air and heat.

The ceiling of an ordinary schoolroom contains about nine hundred square feet of surface, and generally consists only of laths and a coat of mortar. In the attic there is frequently only a single floor over the ceiling of the room below, and frequently no floor at all.

With the temperature of the air at the top of the room from 80 to 90° F., and that of the attic at thirty degrees, or lower, as it may be on a cold day, it is easy to see what an amount of warm fresh air is lost. This is particularly noticeable in the plenum method.

The objection has been made to the exhaust system of ventilation that the air is drawn into the room from every crevice in the walls, floor and ceiling, and also from the corridors and clothes rooms.

The objection can also be made to the plenum system that the impure air is driven out at every crevice and opening, thus possibly forming accumulations of foul matter and disease germs in places that cannot be reached to be cleaned; also that a considerable part of the warm fresh air which enters at the inlet at a higher temperature than at the breathing line escapes through the ceiling and walls before it has circulated and reached the breathing plane, thereby causing a loss of heat that could be utilized within the room.

With the plenum system there is always a leakage of air from the room, as there also is with a gravity system when the exhaust is insufficient, and if this leakage takes place from the air at 90 to 100 degrees it is evident that more heat will be lost than from air at 70 degrees.

(To be concluded in the May issue)

THE HEATING AND VENTILATING MAGAZINE

PUBLISHED MONTHLY AT
1123 BROADWAY, NEW YORK
BY THE
HEATING AND VENTILATING MAGAZINE CO.

A. S. ARMAGNAC, EDITOR

European Representative:
AMERICAN PUBLICATION BUREAU, 58 Manor Park Road, Harlesden, London, N. W.

Subscription, - - - - - $1.00 per year
Foreign countries, - - - - 1.50 " "

FROM three different sources lately have come attacks on mechanical ventilation that would indicate that a systematic campaign has been set on foot to disparage the advantages of forced ventilation in the minds of owners and those who do the building. One of these attacks comes from England and is easily recognized as a continuation of an affair which resulted in an exposure of animus and methods which were far from creditable to the promoters of at least one system of natural ventilation.

The other two attacks are found in American papers and they are of interest merely as showing the activity of the promoters of natural ventilation in furthering their interests. It is well for heating and ventilating engineers to know of these attacks and answer them as they appear, for while it is true they do not influence to any extent the professional builder, yet they are likely to have a disquieting effect on the owner, in whose hands they are being placed. It is reassuring to know, however, that the sum of the arguments in favor of natural over forced ventilation can be stated as they are, in the following words:

"While inferior to none in results, the first cost is very much less than any other system; the expense for operation is eliminated; it can be installed in an old building almost as cheaply as in a new; it permits of heating the entire building by direct radiators (where steam or hot water is used), the cheapest and best method of heating; no skilled engineer is required to operate it; and where power is not used for other purposes, allows the use of low pressure boilers with their natural saving in fuel.

"In a nutshell, the owner or manager who furnishes his tenants with offices or apartments properly equipped for ventilation and humidity can demand and get more rent; his interior woodwork will not shrink and crack, calling for constant repairs; he can heat his building with less expense, as it is a well known fact that pure, moist air takes less fuel to heat than foul, dry air; he has a happy, contented, healthy set of tenants, and last, but not least, is doing humanity a service."

---

ON another page will be found a unique test of the heating apparatus in a factory building made by means of a recording thermometer which shows, among other things, the possible use to which recording thermometers may be put in guiding the operation of the heating system so as to maintain a more even temperature under known outside conditions. Such a use of recording thermometers can be made of considerable value not only as aiding the operating engineer to lower his fuel bill, but by establishing a basis in insufficiently heated buildings for estimating the additional radiation required. In the former case, it is possible to learn from a test such as that described whether it is necessary to keep on steam in a build-

ing throughout the night, or, if the steam apparatus is shut down, at what time in the morning it is necessary to again start up the fires. Other information may be gained from tests of this sort, such as learning the length of time a building of known construction will retain heat, with certain outside temperatures, after the steam is shut down; showing, in other words, the capacity of the building to store heat. Other tests along the lines already followed will be published in subsequent issues.

A DEVELOPMENT that is taking place in connection with the power plants of office and other similar buildings in some of our larger cities will soon, it is said, have a marked effect on the design of such plants. We refer to the supply of electric power from a central station sufficiently great to obviate the use of high pressure boilers. How far this has gone may be judged from the fact that in New York alone the number of buildings that have within the past year discarded their boilers in favor of electric power shows a very marked increase over the previous year. The electric power interests are thus utilizing not only all the available power generated at their own plants, but, by co-operating with the traction companies, are able to make use of the full capacity of the railroad and elevated power houses at times when the latter would, under ordinary conditions, be partially shut down. There is a point at which buildings may be sufficiently large to make a plant of its own economical as compared with buying its power in this way, but in smaller buildings the cost of electric power has been reduced to such a degree as to render it a formidable factor in the operation of the power plant. In one New York building, at least, that has come to our notice, a full complement of boilers was designed only to be discarded at the last moment, when a proposition for the use of electricity was too convincing on the side of economy to admit of any other course.

QUITE by coincidence we publish in this issue two expressions of opinion on the subject of upward ventilation for schoolhouses, both from the pens of experienced and competent observers, yet differing radically from each other in their conclusions. It will be noted that one of the main points made by Prof. William J. Baldwin in favor of upward ventilation for schoolhouses is that the best results from the upward system are obtained in large rooms, such as those usually found in schools. Mr. Joseph A. Moore, on the other hand, after stating the objections to upward ventilation, concludes in favor of the downward system on the ground that "by exhausting the foul air from the bottom, a downward movement of the warm air entering at the top of the room is maintained, and as the poisonous products of respiration must be diluted and removed by the introduction of pure air, a circulation within the room is maintained, which will produce the required results."

WE are pleased to note a very general demand for our booklet containing the ventilation laws now in force in this country. It is interesting to know that quantities of these books are being placed in the hands of the office forces of heating engineers as well as those of supply houses.

# Upward and Downward Ventilation

By William J. Baldwin

A LETTER

Editor Heating and Ventilating Magazine:

The extract of the discussion in your February issue on the relative merits of top and bottom ventilation of rooms or auditoriums, brought about by the paper of Mr. Wilhelm Dahlgren, of Stockholm, on the upward and downward systems of ventilation introduced by him into the Parliament Building (Riksdag), at Stockholm, induces me to say a word on the subject of upward and downward ventilation.

The extract of Mr. Dahlgren's paper is most interesting, and its chief merit is that the writer seems to be actuated only by a desire to contribute an item of interest to the history of the subject, based on what may be called a dual example of the two systems, as applied to a most important building in a cold country.

Regardless of our individual opinions, very few of us are able to give data on so important a subject. It is actual conditions we want, and not speculation.

## UPWARD VENTILATION FAVORED

I have warmed and ventilated buildings, and I have used both the upward and the downward systems, but always in different buildings. I have been able to draw conclusions from these different buildings, and my conclusion in the matter of auditoriums has always been in favor of upward ventilation, or, to make it plainer, in an upward movement of the air within a room or auditorium.

## A STANDARD OF "IMPURITY"

There are three things to be considered in relation to the ventilation of any room: First, the admission of sufficient air to establish what ventilating engineers are sometimes pleased to call a "standard of purity." A standard of purity may, if you please, be called a standard of "impurity," as it is always measured by the impurity that can or should be tolerated within a building, as contrasted with the measure of impurity that exists in the outer atmosphere for any particular location. In a fixed location we cannot hope to have any better air than exists out of doors, except that we may select the position of our "intake" so as to get the least amount of dust possible. Dust, however, does not enter into the question of the standard of impurity that can be tolerated within an inclosure, so that our measure of impurity is only a measure of the vitiation given to the air by the exhalations from our lungs and our bodies.

## METHOD USUALLY FOLLOWED

The method usually followed in the ventilation of our modern and recent school rooms in the United States, and in Europe where I have had an opportunity to examine them, is to admit the air into the room through an opening above the head-line, and to draw it out of the room at an opening near the floor.

It is our custom also to put a register in this same foul air flue at a point near the ceiling, and this upper foul air register is always a full register, with valves, so that it can be closed.

Now, what is this upper foul air register for? On the face of it, it is a compromise. As an engineer I do not dare to omit it, and would not omit it except under special orders from my client, and then I would omit it with a protest. It is a compromise, however. It is a compromise for the occupants, so that if they are not satisfied with "bottom ventilation," they can open the top register and have "top ventilation," and, in fact, they can have the foul air going out at both the top and the bottom at the same time, thus giving them three options and hoping that by so doing they will not find fault with the engineer.

Compromises, however, are cowardly, and I am not sure but that I do a cowardly thing every time I assist in the ventilation of a school room

under the conditions of buildings which exist to-day.

USE OF CEILING OUTLETS

On the other hand, I can make arguments to justify what I do, and if I were given the choice of having but a single outlet—that is, the choice between a floor and a ceiling outlet in a school room (and the same applies to a hospital room)—I would take the ceiling outlet.

The greater number of all the persons who pretend to be authorities on this subject, and who entered such a room, would at once take me to task, and point out that I was "wasting heat," that "I could not keep my floors warm," and that in a cold country "the children would have cold feet."

The cold feet (unless I used coils under the windows) I would have to acknowledge, under most conditions. From the point of ventilation alone, however, I would be prepared to defend myself.

ARGUMENTS FOR LOWER OUTLET

On the other hand, if I omit the vent register near the ceiling, a number of my critics will say, "such a room cannot be properly ventilated," while the majority of them would probably argue that to be theoretically correct I should use nothing but the lower outlet. They would give two reasons: (1) that the lower outlet is the correct position from the point of economy of maintenance (and in very large schools and hospitals the cost of maintenance is a matter to be considered); (2) that the lower outlet is the proper one to maintain a constant standard of impurity for all parts of the room, and they would bring in a reference to the fact that carbonic acid being heavier than air would find the floor more easily, thus allowing the most vitiated stratum of air, which is supposed to be at the floor, to go out first.

SIZE OF ROOMS SHOULD BE CONSIDERED

Now, while this reasoning may be correct in regard to rooms crowded with persons, with a small increment of fresh, warm air per capita, I do not think that it is at all correct where large quantities of air per capita (equal to that required for schools or hospitals) are being admitted.

When a quantity of air equal to about 100,000 cubic feet of air per hour is admitted to a school room in which there are fifty children, the room being approximately 24 feet by 32 feet on the floor, so much air is admitted and extracted every hour (and admitted at a temperature, even in pretty cold climates, so near the temperature at which it is extracted) that the waste due to drawing the air from the ceiling (if waste does exist at all) is so inconsiderable that it should be a negligible quantity, and should be provided for in the appropriation for fuel.

On the other hand, I believe it will be found by careful study, aided by chemical analysis, that the "standard of impurity" of the air of a room at the breathing line can be maintained with a somewhat less admission of fresh air, when the air is drawn off at the ceiling than when it is drawn off at the floor, so that the lessened quantity of air (that has to be warmed from the outside to the inside temperature) will offset the heat lost with the greater quantity.

This, of course, is a refinement, and it is only brought in here to show that accurate measurements for ordinary school conditions would prove that there might be an actual economy in letting the foul air escape at the ceiling, provided the "standard of impurity" only had to be maintained by statute, rather than that a certain quantity of air had to pass through the room in a given time.

At the most, the quantity of heat lost by top ventilation cannot exceed the quantity of air passed through a room in a given time, multiplied by the difference of temperature at or near the floor and the temperature at or near the ceiling, say two or three degrees Fahrenheit.

THE CASE OF A SMOKING ROOM

Let us imagine a school room, in which there are fifty gentlemen smoking, instead of fifty children, and this room has nothing but bottom ventila-

tion. What will be the condition of the room? When we are dealing with the ordinary vitiation in schools or hospitals, we cannot see it. When we are dealing with tobacco smoke, it is an entirely different matter. We see it, and we note that the tobacco smoke will go directly to the ceiling and then begin to pack down in a cloud, until it reaches the floor or the top of the lower register, when it begins to flow away. This is the standard of impurity, and the smoker lives and breathes in it, and saturates his clothing and his neighbor's clothing, and the standard of impurity (or purity) is a roomful of smoke.

Now, we do know that when this smoke can escape at the top of the room, and fresh air is coming in below, that the standard of impurity is not the same. The foul emanations that rise flow off at the upper level.

### SAME CONDITIONS IN HOUSE VENTILATION

I have the same condition in my own bedroom. Although I had a fireplace in it, my bedroom would become hot and foul, until I had a register placed in the chimney flue very near the ceiling. I have had the same thing done to nearly every room in my house, and on a cold night when the house was crowded at a reception, one of my guests lifted the window shades and said, "Why! Your windows do not become frosted! I cannot have ten persons in my parlor for half an hour without having my windows frosted under such conditions as these." So indeed did I have my windows frosted before I put in the registers near the ceiling. The excessive moisture in the air, that condensed on the cold glass of the windows and froze, was evidence of the vitiation we were living in. When the moisture disappeared, it was reasonable to assume that the other vitiation disappeared in the same ratio, and that the standard was better.

### RESULT OF BOTTOM OUTLETS IN HOSPITAL

Another condition which came very forcibly to the writer's attention was at the time the first Sloane Maternity Hospital was being built (about 1887). Dr. Dalton, the great writer on Human Physiology, who was then the Dean of the College of Physicians and Surgeons, worked with the writer on the ventilation of this building, and the question came up as to whether there should be top or bottom ventilation, or both. The doctor was a man who decided that there was a right way in everything, and held that we should have bottom ventilation only, and bottom ventilation only was provided. At this time there was an accouching room on every floor of the hospital, and it became necessary to use chloroform in large quantities on one occasion. It was before the general use of electric lights, so that gas was being used in large quantities in the room. There was present the attending physician, with about six students. During the operation, each person began to feel uncomfortable and giddy, and each supposed that he alone was affected. In a few moments, however, all present were looking at one another and wondering what was the matter with them. The physician in charge, however, seemed to realize what was happening, so that he called for blankets, threw them over the patient and opened the windows.

What did happen in this room was, that the chloroform combined with the products of combustion from the gas fixtures in sufficient quantities to make a poisonious gas that was of sufficient virulence to affect all present. The gas had to fill the chamber and pack down to the floor before it could escape. Orders were promptly given to "cut in" the upper registers, and thereafter there was no complaint from these rooms. Here is one case at least where top ventilation was an absolute necessity.

### THE VENTILATION OF THE NEW YORK STATE CAPITOL

Another case in point. In the capitol Building, in Albany, when it was first constructed, provisions were made for ventilating the Senate Chamber and the House of Assembly from the bottom upwards. After the forced remodeling of these cham-

bers the then State Architect changed the ventilation to downward ventilation, so as to admit the air at the top and take it out at the bottom, which was partly forced on him by the alterations in the building. Since that time the ventilation of the House of Assembly has been most unsatisfactory. The air is admitted through the ceiling and taken out through the floor, and it comes down in direct draughty currents on the heads of the occupants at times, while at other times it comes down uncomfortably hot. The hot and cold are relative, as the temperature of admission is always about the same, but the differences that exist are due to the condition of the weather outside. In warm weather, when large quantities of air have to be admitted at rather low temperature, it comes down cold. In cold weather, when the air has to be admitted pretty warm to keep up the general temperature of the chamber, it comes down hot. In any case, there is discomfort. The writer has reported on the ventilation of this building within a year, and has recommended upward ventilation. WM. J. BALDWIN.

New York, April 3, 1906.

### Circulation of American Magazines

An interesting compilation has just been made of the circulation of the best known American magazines. This list, as published by the American Radiator Company, is as follows:

| | Copies Printed Each Issue. |
|---|---|
| Century | 175,000 |
| Scribner's | 200,000 |
| McClure's | 400 000 |
| Munsey's | 650,000 |
| Everybody's | 650,000 |
| Leslie's | 275,000 |
| Collier's | 600,000 |
| National | 225,000 |
| Madame | 200,000 |
| Delineator | 950,000 |
| Harper's Bazar | 250,000 |
| Country Life in America | 60,000 |
| World To-day | 125,000 |
| Good Housekeeping | 225,000 |
| Saturday Evening Post | 730,000 |
| Ladies' Home Journal | 1,050,000 |
| Christian Herald | 275,000 |
| Ladies' World | 530,000 |
| Literary Digest | 125,000 |
| American Homes | 20,000 |
| Rural New Yorker | 60,000 |
| Youth's Companion | 350,000 |

## NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS

### Atlantic City Captures National Convention

The board of directors has named Atlantic City, N. J., as the place for holding the eighteenth annual convention of the association. The dates will be Wednesday, Thursday, Friday, and Saturday, June 20, 21, 22, and 23, and headquarters will be at the St. Charles Hotel. This decision was arrived at after the board had gone over at length the advantages of holding the convention in the Middle West, which arose from the fact that the most notable increases in the Association's membership during the past year have been in sections west of the Alleghanies. One of the deciding factors, it is understood, that led to a choice of Atlantic City was the coming meeting of the National Association of Master Plumbers at that place during the last week in June. Those interested in each organization will now be able to attend both conventions in practically one trip.

### Indiana State Association

Indiana State Association of Master Steam and Hot Water Fitters, Indianapolis, Ind., held its annual convention on March 8 last in the Claypole Hotel, of Indianapolis. The following officers were elected: President, James M. Healy, Indianapolis; vice-president, E. A. Werkhoff, Lafayette; secretary, Herman Goth, Indianapolis; treasurer, P. F. Freany, Indianapolis; delegates to the national convention, D. A. Westbury, South Bend, and E. A. Werkhoff; members of the state executive committee, D. A. Westbury, John O'Donnell, Evansville, and George H. Kirkhoff, Indianapolis.

During the meeting a resolution was passed criticizing the architects for trying to dictate plans and specifications in regard to heating that are not practicable. The secretary was requested to send copies of this resolution to all the architects in the state.

The Newark (N. J.) Association held its annual meeting March 20, at which the following officers were elected: President, Harry Geiser; vice-president, Walter A. Lawson; treasurer, William M. Whitlock; secretary, Sol. Berla.

At the annual meeting of the New York City Association, March 27 last, the following officers were elected for the ensuing year: President, Frank Dobson; vice-president, Charles N. Brizse; secretary, Henry B. Gombers; treasurer, William J. Baldwin, Jr. Board of Directors—Frank Dobson, Charles N. Brizse, Will-

iam J. Baldwin, Jr., Albert N. Chambers, and George A. Suter.

The twelfth annual convention of the New York State Association will be held in Syracuse, N. Y., Thursday, May 3, at 2 P. M. The sessions will be held in the Vanderbilt Hotel.

## AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

As we go to press we are advised that a meeting of the Board of Governors of the Society is about to be held to decide the time and place for holding the Society's summer meeting. It is probable that the claims of the western members for holding a meeting in the midwest will be recognized and that the choice will fall on either Chicago or Milwaukee. The dates will probably be about the middle of the month of July.

# NEW DEVICES

### The Arco Water Heater

The desirable features sought in tank heaters are simplicity of construction and the ease with which they may be set up and connected. A type that meets these requirements is the Arco Water Heater, which is made substantially in three pieces—base and grate, combination pot and combustion chamber, and a top with a deflecting ring.

SIDE VIEW OF ARCO WATER HEATER

The pot is fed from the top and is deep, carrying an ample fuel supply. A clinker door at the base of the pot makes it easy to slice the top of the grate.

The top is so formed with an inner deflecting plate that the heated smoke and gases are drawn to the front, where they separate and pass under the top plate and around each side to the smoke outlet. While intended primarily as a water heater for domestic supply and other purposes requiring tepid or hot water, the top can be used on occasion for heating a few flatirons. The top has a lid ring which can be removed for setting in a clothes boiler or other receptacle.

The ash pit is provided with a bottom and four feet, so that the base can be set

PARTS OF ARCO WATER HEATER, SHOWING SIMPLICITY OF CONSTRUCTION

safely on wood or any other flooring available. The grate is made on the rocking and dumping principle and is provided with a strong crank shaker. Lugs on the shaker prevent accidental dumping.

The outlet for the hot water pipe is placed in a heavy boss at the upper side of the fire pot, while the inlet is placed at the lowest point on the opposite side, thus causing the water to circulate throughout the entire interior of the hollow fire pot casting.

This heater is made in three sizes, 10, 12 and 15 inches, and the oval smoke-pipe collars for the three sizes are made to fit into oval 4 and 4½ inch commercial smoke-pipe as listed.

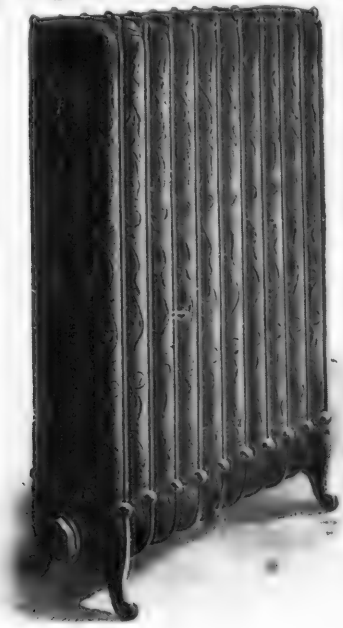
### A New Line of Radiators

The A. A. Griffing Iron Company, Jersey City, N. J., announce the completion of patterns for their new Columbia line of plain and ornamental cast-iron steam and water radiators. Cuts presented herewith illustrate three of the patterns;

namely, one-column plain, three-column plain, and four-column ornamental. In addition, there is made the two-column plain and ornamental, and the four-col-

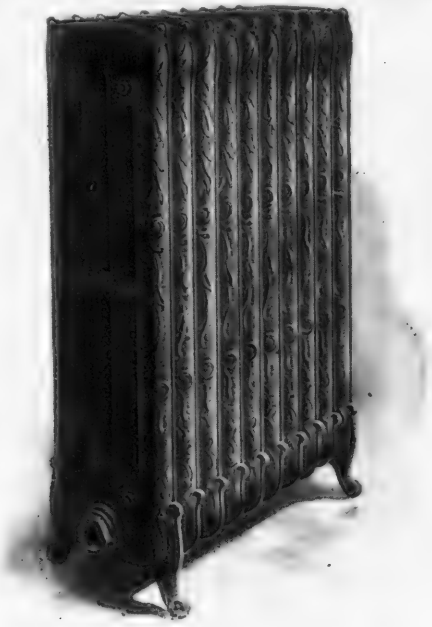
BUNDY COLUMBIA ONE COLUMN PLAIN RADIATOR

umn plain. Throughout the entire line of patterns the ornamental design is uniform, as well as the general outline constructive features, thus offering to the heating engineer and contractor radi-



BUNDY COLUMBIA THREE-COLUMN ORNAMENTAL RADIATOR

ators which, in appearance, heights and widths, are adapted to fit conditions of space and design as found in modern buildings. The manufacturers state that their equipment is complete in every particular, and they are prepared to accept and fill orders for this season's demands. Also that they have just completed a new descriptive catalogue, which



BUNDY COLUMBIA FOUR-COLUMN ORNAMENTAL RADIATOR

will be mailed to all inquirers mentioning this journal.

## Professor William Kent on the Metric System

Professor Kent, of Syracuse University, in a letter to the New York *Tribune* on the present agitation that is going on regarding the use of the metric system, says, among other things: "All of the arguments in favor of the metric system were published by its advocates in this country more than thirty years ago. For all these years they have maintained one or more metric societies for continuing a propaganda of that system; they have deluged the country with literature on the subject; they have had it incorporated in the arithmetics and taught in every common school in the country; they have besieged Congress with petitions; they have had bills introduced in nearly every new Congress providing for the compulsory adoption of the system, and have had hearings before the Committee on Coinage, Weights and Measures. With the activity of the tariff reformers, and with equal eloquence, invective and ridicule, they have labored in season and out of

season, and with equal success. They have made thousands of converts, especially among newspaper editors and "closet philosophers." But, like them, they have labored in vain, so far as practical results are concerned. They have not succeeded in getting a metric bill through Congress since 1866, when an act was passed making the use of the metric system legal for any one who wished to use it. The people who actually use weights and measures in the mining, agricultural and manufacturing industries and in domestic and foreign commerce have not been converted. They go on multiplying rules, scales, weights, measures of bulk and making drawings, patterns, tools, and articles of manufacture by the millions, all based on the English inch. They have divided land and recorded deeds with English measures of length and area. They have published plans, drawings, books, and technical papers for the use of every student and artisan, in which every dimension and weight has been stated in the English system. They have refused to consider the adoption of the metric system as even a possibility.

And these people who thus stubbornly ignore the metric system are the most intelligent, active, progressive, and far-seeing people on earth. They have revolutionized systems of manufacture and commerce. They have advanced the United States to the first position among manufacturing and commercial nations. They are no more apt to be blind to their own interests in regard to systems of weights and measures than they are in regard to the tariff.

During all the years of the propaganda of the metric system these practical people have remained unorganized, so far as opposition to the metric system is concerned. Only now and then some one among them writes an article on the subject for some newspaper or reads a paper on it before some technical society. They have no anti-metrical society or club, although England has had one for about a year.

Only within the last two or three years have the opponents of the metric system waked up to the fact that there is actual danger of a bill in favor of the metric system passing Congress, but in that time they have done some splendid work. When it appeared two years ago that the Committee on Coinage, Weights and Measures was unanimously in favor of the last metric bill that had been introduced in Congress, they appeared at the hearings before that committee and made such strong arguments against it that the bill was never reported. The American Society of Mechanical Engineers had a thorough discussion on the subject and appointed a bipartisan committee of four, two in favor of the system and two against it, to bring in a report of the arguments for and against the system. Both the discussion and the report may be found in Volume XXIV of the transactions of the society. Let any one who has not yet made up his mind in regard to the metric system read the book above named and the discussion and report referred to, and he will be convinced that, no matter how good a thing the metric system may be from a purely academic point of view, and no matter what legislation may be passed in its favor, there is no more chance of its being generally adopted by the English-speaking nations than there is of the universal adoption of the French language.

## Exhaust Ventilation for London's New Subway

The latest addition to London's system of underground railroads is the Baker Street-Waterloo "tube." It is about four miles long and runs north and south, traversing all the older lines and serving as a link with more connecting lines than any other railway in London.

In the ventilation of this new subway a lesson has been learned from the experiences gained on the Central London tube, in which, some time after its construction, it was found necessary to adopt a system of mechanical ventilation to supplement the train action—deemed at the outset sufficient in itself to secure a current of non-polluted air. To this end a large mine fan of the Guihal type was installed at the tunnel mouth, and the air sucked out the whole distance from the Bank terminus. By this means the tunnel undergoes every night what Sir Benjamin Baker called a "spring cleaning."

It is claimed for the method decided upon in connection with the Baker Street & Waterloo Railway that it is an improvement on the system in question, upon the principles of which it is, however, based. By the "exhaust" process, as it is called, which has been adopted, the air is drawn by a fan from the tunnels and ejected by means of a closed duct at the roof of the station, the fresh air coming in at the street level by way of the lift and stairway shafts. Special stress is laid upon the fact that this method, by taking out air in a closed duct from the top of the tunnels, will effectually remove any smoke that may be occasioned from unforeseen causes, while at the same time the passageways serving as exits for the public will be kept supplied with a flow of fresh air emanating from the surface and replacing the polluted air. To insure that a sufficient current will be available, seven large fans have been provided, each designed to exhaust 1,000,000 cubic feet of air per hour. These, being constantly at work, will be capable each of changing the air in one mile of tunnel every half hour.

# TRADE AND MISCELLANEOUS NOTES

### Deaths

**Herbert W. Nowell**, until recently connected with the Kinnear Pressed Radiator Company, died at his home in New York, March 25 last, of pneumonia. Mr. Nowell was a member of the American Society of Heating and Ventilating Engineers, and read a paper at its 1905 midsummer meeting, on the subject of sheet metal radiation. He was 52 years old. Most of his life had been devoted to the heating trade as a representative of boiler and other firms. He was at one time connected with the Gurney Heater Manufacturing Company. At the time of his death Mr. Nowell was engaged in the heating contracting business in New York. Mr. Nowell made many friends in the trade, to most of whom the news of his death was entirely unexpected.

**Augustus A. Dame**, president of Dame & Townsend Company, 27 Cliff street, New York, died at his home in Brooklyn, March 30. He was 64 years old. Mr. Dame was connected with the steam and mill supply trade most of his life, being at one time manager of the New York office of the National Tube Company. In 1887 he became president of the Dame & Townsend Company, and was, at the time of his death, the president and treasurer of that firm.

**Charles Perkes**, for many years a manufacturer of steam-fitting and plumbing supplies at 627-629 Arch street, Philadelphia, died in that city March 7. He was 77 years old.

### Trade Literature

**Herendeen Manufacturing Co.** has issued a souvenir containing the proceedings of its recent convention of the representatives of the company at Geneva, N. Y. In addition to the report of the convention, the contents include a portrait of E. W. Herendeen, the founder of the company, and also the principal addresses made at the convention, including a paper by Edward S. Dean, on "Why Water Leaves the Boiler;" E. W. Man-

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deville, on "Greenhouse Heating in New England," and by Edward S. Dean on "Experiences in Burning Western Soft Coal."

**Gardner Engineering Company,** 136 Liberty street, New York, sales agents for the Golden-Anderson Valve Specialty Company and for the "Lyon" Steel Lockers, are issuing to those interested catalogues fully illustrating their specialties. Their valve stock, as described, includes cushioned non-return valves of several types, Anderson patent pressure reducing valves, automatic valves and water columns, float and altitude valves; also the Golden automatic tilting steam traps. Size of catalogue, 5x7¾ inches. Pp. 36.

**Webster "Star-Vacuum" Feed Water Heater, Purifier, Filter and Receiver** is described and illustrated with half-tones in an appendix, just published, to the firm's general catalogue. Sectional and detail views, also a plan of the apparatus, accompany the description of it and make its operation easily understood to those interested. Other feed water heaters are also described in the catalogue.

### New Corporations

**Cincinnati Light, Heat & Power Co.,** Cincinnati, Ohio, has been incorporated with a capital of $100,000. The incorporators are: H. H. Bechtel, Guy W. Mallon, R. E. Stearns, C. W. Call and Cyrus E. Mead.

**Morton Plumbing & Heating Co.,** Wichita, Kan., has been incorporated with a capital of $5,000.

**American Heater Mfg. Co.,** Chicago, Ill., has been incorporated with a capital of $5,000, to manufacture heating goods. The incorporators are: H. R. Stewart, F. W. Packard and K. P. Collins.

**W. L. Miller Heating Co.,** Chicago, Ill., has been incorporated to install heating systems, with a capital of $25,000. The incorporators are: William L. Miller, William Wildman and Frank W. W. Miller.

**Vacuum-Vapor Co.,** Moline, Ill., has been incorporated with a capital of $35,000 to install heating systems. The incorporators are: Cyrus E. Deitz, Gust. A. Shallberg and Charles S. Korns.

**Balanced Draft Co.,** New York, has been incorporated with a capital of $5,000 to manufacture appliances for forced draft boilers. The incorporators are: J. H. Griffiths, W. C. Lillieholm and H. A. Bingham.

**Van Haaften Sheet Metal, Heating & Plumbing Co.,** Kalamazoo, Mich., has been incorporated to carry on a heating business, including steam, hot water and hot air, and also plumbing, sheet and metal work.

**Corona Mfg. Co.,** Corona, Cal., will be incorporated with a capital of $25,000 to manufacture the Corona Solar Heater.

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**H. & M. Automatic Regulator Co.,** Rochester, N. Y., has been incorporated with a capital of $50,000. The incorporators are: Willard W. Wadsworth, of New York; J. M. Taylor and G. E. Taylor, of Rochester. The new company will combine the business of Davis & Roesch Temperature Regulating Company, of Newark, N. J., with that of Hohmann & Maurer Manufacturing Co., of Rochester.

**National Superheater Co.,** New York, has been incorporated with a capital of $200,000 to manufacture boilers, engines and heaters. The incorporators are: E. C. White, Charles V. D. Peek and R. B. Gray, all of New York.

### Business Changes

**Weatherly & Pulte,** Grand Rapids, Mich., have dissolved partnership. Mr. Weatherly will devote his time entirely to heating, while Mr. Pulte, with his sons, will continue business under the name of the Pulte Plumbing Company.

**United States Heater Co.,** Detroit, Mich., has increased its capital $75,000, of which $55,000 will be preferred and $20,000 common.

### New Firms

**Johnson Plumbing & Heating Co.,** Omaha, Neb., is the name of a new firm engaged in the heating and plumbing business.

**Libby Valve & Packing Co.,** New York, is the name of a new firm which will take over the steam specialty and mill supply business of the Libby Manufacturing Company. The capital is $25,000, all of which is paid up. The president is R. O. Libby and the secretary and treasurer L. D. Libby.

**Bannigan, Cooper & Stressel,** Utica, N. Y., is a new firm which will carry on a plumbing and heating business. Mr. Bannigan and Mr. Stressel were formerly connected with the Stradling Plumbing & Heating Company, of Utica, and Mr. Cooper has long been associated with Hart & Crouse, of Utica.

### Miscellaneous Notes

**New York Trade School,** First avenue and East Sixty-seventh street, New York, held its graduation exercises April 6 last, when classes in both plumbing and steam fitting were graduated.

**Henry R. Dalton, Jr.,** Indian Orchard, Mass., has resigned as treasurer of the Chapman Valve Manufacturing Company and will continue business in Boston.

**W. L. Herendeen,** Geneva, N. Y., has accepted the position of commissioner of


PIPE HANGERS

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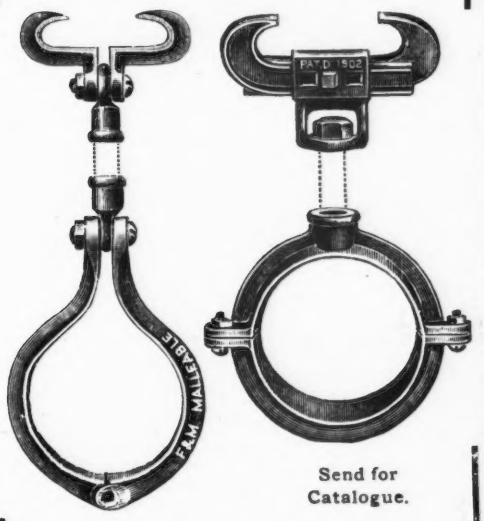


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the National Foundrymen's Association, with headquarters at Detroit. Mr. Herendeen is also treasurer of the Herendeen Manufacturing Company, of Geneva.

### Manufacturers' Notes

**D. T. Williams Valve Co.,** Cincinnati, Ohio, is negotiating for the purchase of a site on which to build a new plant, which will cost about $150,000.

**Union Steam Pump Co.,** Battle Creek, Mich., is building an addition to its plant. This will enable the company to enlarge its foundry and pattern departments.

**New England Boiler Co.,** Mystic, Conn., has bought about five acres of land for a new foundry and machine shop, where steam and hot water heating boilers and special radiators will be manufactured. Bids are being received for this plant, which will be 225 feet long and 64 feet wide.

**Richmond Light, Heat & Power Co.,** Richmond, Ind., is making arrangements for the improvement of its plant which will cost about $45,000. New and modern machinery will be installed, including new boilers. Contracts for the work will be let as soon as bids have been received at the home office of the company in New York.

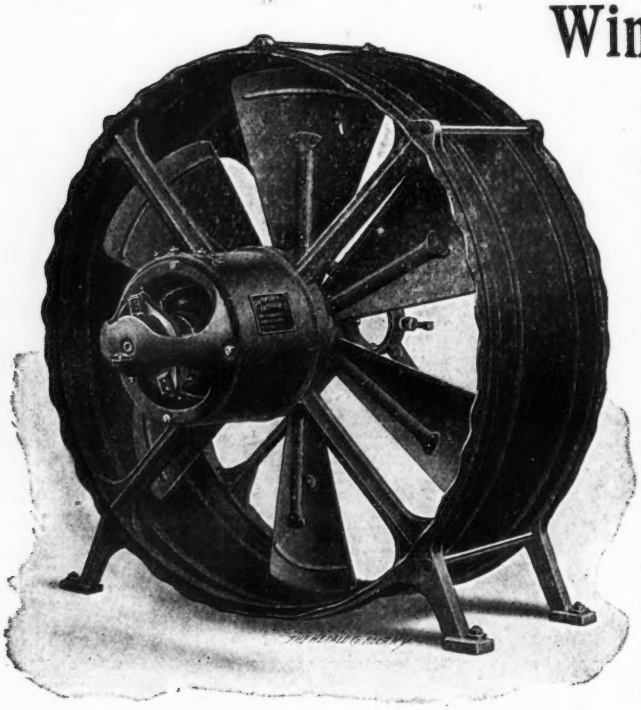
**International Heater Co.,** Utica, N. Y., is building an addition to its plant, which will be 257 feet long and 77 feet wide, and will join the main warehouse at Utica on the east, and will be used as an assembling room and for the storage of castings to be assembled.

**Frevert Machinery Co.,** New York, has opened a salesroom and offices at 18 Dey street, where the firm carries a line of new and second-hand metal-working tools and machinery. This firm also manufactures a line of newly-designed hand-power traveling cranes, trolleys, hoists, and overhead tracks. The office will be in charge of Mr. H. F. Frevert, the principal of the company.

**Kellogg - McCrum - Howell Co.,** New York, has added a Pittsburg office to its list of branches. This office will be under the management of Louis Helmer, who has been with the Crane Company, of New York.

**Colwell Lead Co.,** New York, has increased its capital stock from $30,000 to $900,000.

**American Engineering Specialty Co.,** Chicago, Ill., held a meeting April 4 last, at which the following officers were elected: President, Warren Webster; vice-president and general manager, James H. Davis; secretary and assistant treasurer, A. J. Simmons. The American Specialty is the western agent of Warren Webster & Co., of Camden, N. J.

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**WING'S Acetylene Generators, etc.**

### Contracts Awarded

**Clarence Dresselhuys,** Aberdeen, S. D., heating and plumbing a new building for Champlin, McDiarmid & Slater. Contract price, $1,850.

**H. W. Johns-Manville Co.,** New York, through its Chicago branch, secured the contract for the installation of the pipe and boiler covering in the new plant of Sears, Roebuck & Company, Chicago, involving an expenditure of several thousand dollars. The covering used was the well-known Fire Felt, which was chosen as being fire-proof, elastic, light in weight, and unaffected by expansion or contraction of pipes.

**L. F. Bannon & Co.,** Kingston, N. Y., plumbing and heating the Hotel Kaiserhoff, at Rhinecliff, N. Y.

**American Foundry & Furnace Co.,** Toledo, Ohio, installing the heating plant in the new school building at Coesse.

**H. L. Miller,** Pasadena, Cal., heating the First Presbyterian church.

**J. W. Comerford,** Joplin, Mo., installing the plumbing and heating in a new building of this place.

**Hurley & Co.,** St. Paul, Minn., plumbing and heating five buildings at the army post near Junction City, Mo.

**P. W. Matthews,** Suspension Bridge, N. Y., steam heating the new building being built by the Niagara University.

**L. J. Wing Mfg. Co.,** New York, furnishing the combination motor-driven disk fans used in the heating and ventilating system of many government buildings at Annapolis, Md. The heating systems are being installed by the New York Steam Fitting Company.

**Charles Beshore,** Marion, Ind., installing a hot water heating plant in the McCleery building.

**John Stock Sons,** San José, Cal., heating the new Harris-Kuhn-Wayland building.

**Bowen Heating Co.,** Philadelphia, Pa., installing a direct and indirect vacuum heating system in the residence of William A. Stern. The contract price is $3,000.

**Lewis & Kitchen,** Chicago, Ill., heating and plumbing the new school building at Logan, their bid being $4,283.

**J. M. Abbott,** Seattle Wash., heating the North Capitol Hill school. The contract is worth $6,883.

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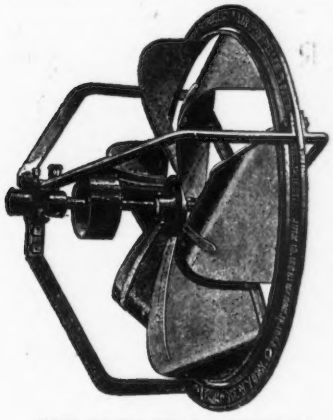

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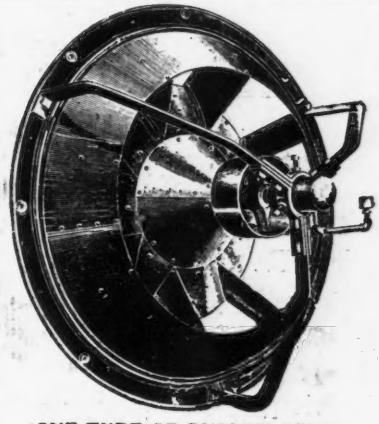

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MANUFACTURERS, ENGINEERS AND CONTRACTORS

**Fred Zipf & Co.,** Johnstown, Pa., ventilating the mines at Oak Hill, Fayette county, West Virginia. The Capwell fans will be used in the work.

**Andrews Heating Co.,** Chicago, Ill., hot water heating Dr. Burke's flats on Fourth avenue.

**George M. McGeary,** St. Paul, Minn., installing a steam heating plant in the Woman's building at the Soldiers' Home. The contract is worth $4,947.

**Prather Construction Co.,** Van Buren, Ark., have sub-let the contract for heating the Crawford County Court House to Bruce Brothers, of Fort Smith.

**C. W. Smith & Co.,** Frankfort, Ind., heating the county farm. His bid was $1,195.

**Malcolm & Dyer,** Augusta, Me., installing the heating and plumbing in the new building of the Augusta Trust Company.

**Foskett & Bishop Co.,** New Haven, Conn., heating and installing a sprinkler system in the waiting room of the Grand avenue station of the Consolidated road.

**John T. Sadler & Co.,** Elmira, N. Y., installing a water heating system in the new Sixty-fifth Regiment Armory at Buffalo.

### Automatic Ventilators for Railroad Coaches

The following interesting experiments in coach ventilation were made recently by the Pittsburg & Lake Erie Railroad Company. A car fitted out with automatic ventilators was placed on a local accommodation train, the same car being also equipped with the old-style ventilators. Alternate tests were made, and the results compared.

When the train started, all the ventilators, doors and windows of the car were closed, and a dense smoke was created by means of burning oiled waste. The ventilators invented by Mr. Taylor were then opened, and it was found that the coach was absolutely free from smoke in 6½ minutes. The train traveled at a comparatively low rate of speed.

By this device, fresh air is admitted through openings in the deck sash of the car, and by means of slats is deflected to the roof. Before entering the car, the fresh air strikes an extended shingle, which causes the dust and cinders to fall to the ground. Simultaneously, the forward movement of the car creates a vacuum in the rear, which sucks out the vitiated air of the car through the rear slats, allowing the cold fresh air to sink toward the floor. Draughts are thus prevented.


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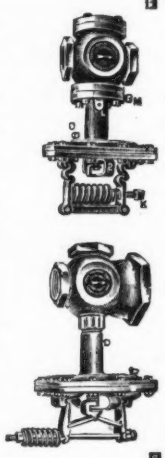

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